DOCUMENT RESUME

ED 208 560 EA 014 134

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TITLE School Furniture. Programme on Educational Building.
INSTITUTION Organisation for Economic Cooperation and Development, Paris (France).
PUB DATE 81
NOTE 162p.
AVAILABLE FROM OECD Publications and Information Center, Suite 1207, 1750 Pennsylvania Ave., N.W., Washington, DC 20006 ($12.50).

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Change Strategies; *Classroom Design; *Classroom Furniture; Demonstration Programs; Educational Change; *Educational Environment; Elementary Education; Foreign Countries; Human Factors Engineering; Preschool Education; *Standards
IDENTIFIERS France; Netherlands; Norway; Portugal; Spain; United Kingdom

ABSTRACT

The experience of designing and making installations of school furniture in collaboration with three countries--Norway, Portugal, and Spain--and of performing additional work in France, the Netherlands, and the United Kingdom provides the basis for this report. The ages of the pupils in the schools concerned ranged from 3 to 13 years. A theme of this report is that the design of school furniture is an integral part of school design itself, and can give teachers the opportunity of making their surroundings responsive to, and convenient for, changing ways of working. Educational assumptions underlying the projects are that children learn at different speeds and in different ways; therefore, school spaces should be flexible and should provide a variety of activities. School furniture should encourage an atmosphere of informality. Diagrams, photographs, and floor plans demonstrate work spaces that fulfill these requirements. Part 1 is concerned with educational developments and their influence on planning and furniture. Part 2 discusses school furniture and its characteristics. Part 3 discusses procedures for design and supply. The appendices offer more detailed consideration of dimensional disciplines, and describe and illustrate the projects in Spain and Norway. Figures, notes, and references are given at the end of each part and in the appendices. (Author/MLF)

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PROGRAMME ON EDUCATIONAL BUILDING

SCHOOL FURNITURE

BY DAVID MEDD

U.S. DEPARTMENT OF EDUCATION
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172 pages ..... F42,00 £4.70 US$10.50

To be published :

SURPLUS SPACE IN SCHOOLS. AN OPPORTUNITY

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CONTENTS

INTRODUCTION 9

Part One

EDUCATIONAL DEVELOPMENTS IMPLICATIONS FOR PLANNING AND FURNITURE

Preparation for change 15
Ways of working encountered in schools visited 15
The educational aims of the projects 17
An educational basis for change 17
Notes 19
Figures 1 to 19 20–57

Part Two

SCHOOL FURNITURE CHARACTER AND CHARACTERISTICS

Piecemeal installations of school furniture 61
The setting for school furniture: general character of the interior 62
Characteristics of a comprehensive range of school furniture 62
Notes 71

Part Three

PROCEDURES FOR DESIGN AND SUPPLY

The objectives 75
Central responsibility 75
Shared responsibility: central and local 76
Local responsibility 76
Guidance through development 77
Guidance through research and national standards 79
Design in partnership 80
Notes 82
Figures 20 to 24 84–91

Appendix I

CATEGORIES AND DIMENSIONAL DISCIPLINE FOR SCHOOL FURNITURE

Seating	95
Work surfaces	95
Storage and display	96
Dimensional relationships	101
Figures 25 to 30	102–111

Appendix II

THE DISTRIBUTION OF CHAIR AND TABLE HEIGHTS

Background	115
Changes affecting distribution	115
The number of sizes	117
The need for data and more rational practice: evidence from the projects	120
Notes	125
Figures 31 to 34	126–131

Appendix III

DIMENSIONAL DATA: SOME EXAMPLES

Sitting and standing measurements for design	135
Storage of pupils' bags and coats	135
Notes	137
Figures 35 to 39	138–147

Appendix IV

DESCRIPTION OF TWO PROJECTS

Spain	151
Norway	153
Figures 42 to 53	156–172

Past studies under the Programme on Educational Building have already devoted a certain amount of attention to the question of school furniture. The investigation of the Building Implications of the Multi-option School showed, for example, how a "workplace" was defined not only by its built environment but also by the furniture and equipment needed to pursue the activity for which it had been conceived. Or again in "Providing for Future Change" it was demonstrated that furniture was a major factor in the flexibility of educational facilities. But furniture had never yet been the subject of a separate study.

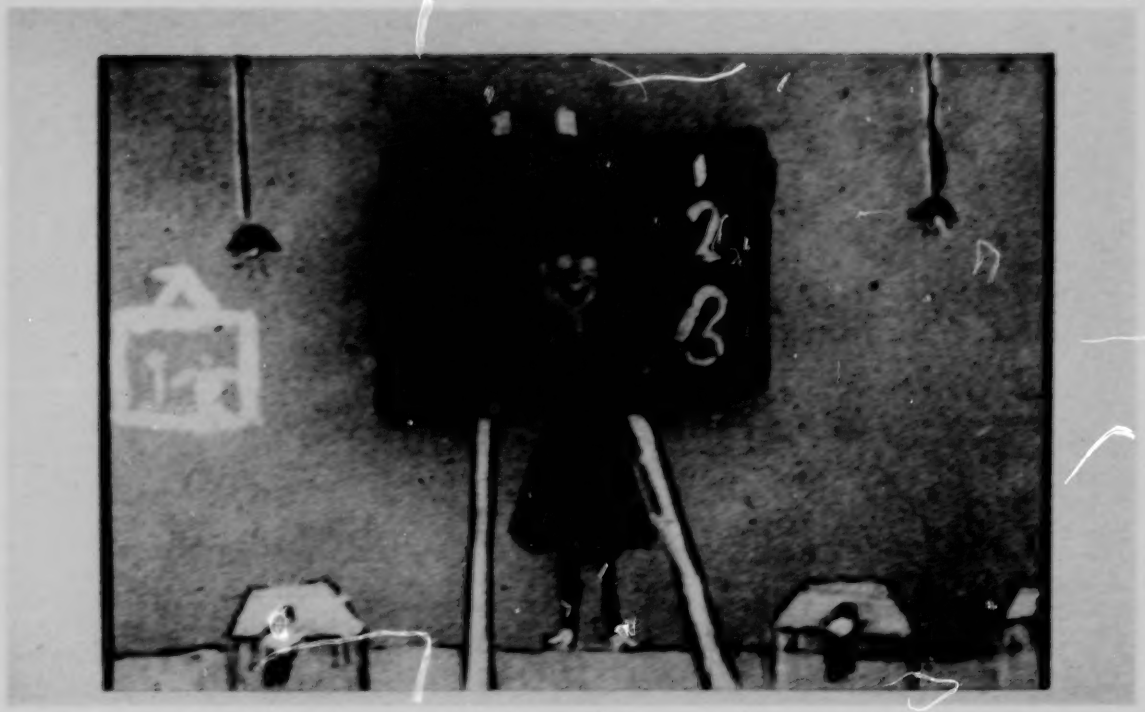
The Programme's Steering Committee wanted this deficiency to be made good for two main reasons. It considered that school furniture offered a particularly rewarding area of application for its general concept of school buildings as educational instruments. Another reason seemed important: more attention is today paid in educational building to remodelling facilities than to designing new ones, and furniture plays a still greater role in the adaptation or conversion of existing facilities than it does in the planning of new buildings.

The approach adopted for this study was to ensure that conclusions capable of generalisation would be drawn from actual cases in which teams of teachers were trying to change the usual educational environment by adopting school furniture which was more appropriate to their teaching needs. This approach assumed that the teams were directly involved in the work and that their experience could at the same time be interpreted with reference to a broader set of problems. The study was therefore put in the hands of Mr. David Medd whose experience in the matter of school furniture and whose contributions to development projects, in the United Kingdom and in other countries, are well known.

Author's note

The Report has involved negotiations with five Member countries, and the setting up of development projects in three. The author would like to thank the PEB Steering Committee for supporting a departure from their normal procedures, and the Secretariat for the continuous support which they have given him during the course of the work and for their advice on the Report. Special thanks are due to the officers in the countries participating in development projects which inevitably caused extra work. The author most sincerely hopes that the additional time and trouble they have so willingly given will be rewarded in the long term.

He would also like to thank Miss J. Dillon, (Research Officer at the Furniture Industry Research Association) who helped him in the preparation of some of the technical material in the Appendices of the Report, and Mrs. Margaret Ross for her patience and persistence on the typewriter.



This painting by a primary school pupil in the 1950's is an eloquent picture of a matter layout, teacher/pupil relationship, lighting, display and furniture, indeed the character of the classroom. This Report is about changes since then.

INTRODUCTION

The contents of this report derive from the experience of designing and making installations of school furniture in collaboration with three countries—Norway, Portugal and Spain—and from experience gained from three others—France, the Netherlands and the United Kingdom. The ages of the pupils in the schools concerned ranged from 3–13 years, representing pre-school and general basic education. The later years of secondary education were not included, because they would have made the subject too diverse for the time available.

It was important that the study should be dependent on practical work in schools, not only to give it reality, but to ensure that teachers and children should be working in the results—for these, unlike a report, cannot be shelved. ("Generalisation comes after precision", A.N. Whitehead). The processes of investigation, designing, building and installation—not to mention the gathering of information and experience from schools in use—have to be measured in terms of years. For this reason, apart from the problems of communication with several countries, the work had to be on a modest scale, yet sufficiently large in scope to be fruitful. It had, however, the privelege of a concentrztion of experience and collaborative design not normally possible on regular jobs, thus acquiring the status of a small development project from which others might benefit, and from which the way ahead might be clarified. Such development projects need only be few in number, but are a means of ensuring that administrative procedures and the building and furnishing of schools keep pace with changing circumstances. Otherwise, accepted precedents are for convenience repeated until the gap between educational developments and the planning and furnishing of schools becomes intolerably wide. (Such a gap can often be obscured by stylistic and technical display, which may give an appearance of modernity, but conceals an outdated interpretation of educational requirements.) By combining the work of live projects with a written record it is hoped that the opportunity provided by the OECD Programme on Educational Building (PEB) may be of particular value to those who have participated, and of general interest to others.

In three of the five countries visited a project materialised. Although one in the United Kingdom was not part of the PEB activity, experience gained there has contributed to the report, and dimensional data obtained from UK research is included where it is considered to be of general value; also some of the examples shown in the Figures come from there. The projects are not specifically mentioned in the body of the report, which is confined to the collective experience gained from them all. To set the scene for the reader, therefore, the following paragraphs briefly outline the work done in each country visited.

France – with a local agency of a central government department

A project did not materialise, but the observation and recording of pre-schools in a rural and educationally enterprising Département yielded valuable evidence of initiative and improvisation, and of problems connected with the design and supply of furniture, both in new schools and in adapted premises, without central guidance or professional skills.

Netherlands – with an independent agency

Again, there was no project, but problems of procurement procedures emerged from discussions and from preliminary designs for a school and its furniture.

9

Norway – with a local authority

The project included the layout of a new furniture schedule in a school designed for 360 pupils from 6–13 years old, the construction of which was started in 1976, and which was opened a year later. The local authority—Baerum Kommune, on the western border of Oslo—wanted, with the Ministry of Church and Education (KUD), to encourage educational development. Authority was given to nominate the furniture manufacturer at the start of the project.

Portugal – with two government departments

This included the design of a range of furniture for supply by central government to Escola Prepatória (middle schools) for pupils from 10–12 years. It followed previous collaboration, under the OECD Technical Co-operation Programme, with the Ministries of Public Works and Education and Science on the design of a range of furniture for pupils from 6–10 years (i.e. in primary schools). This had been in production for four years, and the middle school range was to be designed as an extension of it. Prototype installations were made in November 1977, since when modifications have been agreed and final designs put out to tender.

Spain – with a government department

The adaptation and furnishing of part of a school designated as one of the "experimental" schools of the Instituto de Ciencias de Educación (ICE) of the Universidad Autonoma, Madrid. The Ministry of Education was making modifications to the building and was concerned about furnishing for a new curriculum and organisation.

The school: Cardinal Herrera Oria EGB (General Basic Education) School was designed in 1969/70 for 640 pupils from 6–14 years. In May 1977 there were 880 pupils in the school (excluding 140 pupils in the adjacent pre-school). The concrete frame building, three storeys high, is on a confined site surrounded by hard playgrounds and tall blocks of flats. It is in the north west suburbs of Madrid.

The project included the re-arrangement of the plan and the installation of new furniture, the aim of the "experiment" being to compare the performance of the original curriculum in unmodified "control" classrooms with that of the new curriculum in the adapted and newly furnished "centres".

Part One of this report is concerned with educational developments and their influence on planning and furniture. Part Two discusses school furniture and its characteristics. Part Three discusses procedures for design and supply.

In Appendices I to III more detailed consideration is given to dimensional disciplines, and Appendix IV describes and illustrates the projects in Spain and in Norway.

Figures, notes and references are given at the end of each Part and Appendix.

Primary School, Sao Martinho do Porto (6–10 years), Portugal
An example of a primary school with furniture designed on the principles described in this report, which has been supplied on a programme basis since 1976.

Part One

EDUCATIONAL DEVELOPMENTS IMPLICATIONS FOR PLANNING AND FURNITURE

PREPARATION FOR CHANGE

The projects have exposed the conflict between those—usually outside schools—who want to encourage change and those—usually inside schools—who are not prepared for it. In those countries where the curriculum is defined by a body outside the school, and where teachers are employed to put it into practice in prescribed ways, the situation is cut and dried. Therefore, although designers learn (or should learn) much of what they know about schools from watching and talking to teachers working with children, it is those outside schools—inspectors, administrators—from whom they receive their instructions. It is the responsibility of these clients to see that any educational changes and departures from precedent they wish to introduce must involve the preparation and cooperation both of teachers and designers. For education, design and teaching methods are interdependent, so that change that does not impinge on all three is unlikely to be successfully achieved.

Unless teachers can come to the new school with an understanding, and therefore with eagerness, administrators and designers will be disappointed, teachers will be uncomfortable, and pupils may suffer. Moreover, when an "experiment" is planned, it needs to be nurtured continuously by those responsible for it; otherwise, if left to chance, it will be susceptible to staff changes, political pressures, and the consequent lowering of morale among those who need support and advice in their pursuit of unfamiliar methods and ways of working. For instance, a change of staff in the formative stages of an experiment, if not planned by those responsible, is likely to mean a reversion to familiar practice, and new planning and furniture will be irksome. Familiar tradition (the rows of desks and pupils facing the chalkboard, which has served for so long) is so deeply ingrained that the majority of teachers see no reason to question, and have had no opportunity to shape their surroundings.

Education, however, has been changing, and it is necessary to question the assumption that familiar precedents will continue to serve. It is equally necessary that administrators, inspectors, teachers and those responsible for their training, designers of schools and of furniture should all assume their respective responsibilities for making change successful.

A theme of this report is that the design of school furniture is an integral part of school design itself, and can give teachers the opportunity of making their surroundings responsive to, and convenient for changing ways of working.

WAYS OF WORKING ENCOUNTERED IN SCHOOLS VISITED

Pre-school

The children in the pre-schools visited, varying in age from about 3 up to 6 or 7 years, were working and playing with a large range of materials and objects, sometimes on their own, sometimes in small groups, sometimes in much larger ones. For these very young children, educational principles are widely shared,[1] but their interpretation in terms of planning and furniture varies from the very inadequate to the excessively luxurious; from the polished proprietary that looks unused, to well-worn improvisations. The design both of the surroundings and the furniture must take into account the intricate and constantly changing small patterns of activity.

Figure 1 analyses some of these, and Figures 2–8 show furniture arrangements (which are often changing) noted in visits to pre-schools.

General basic school

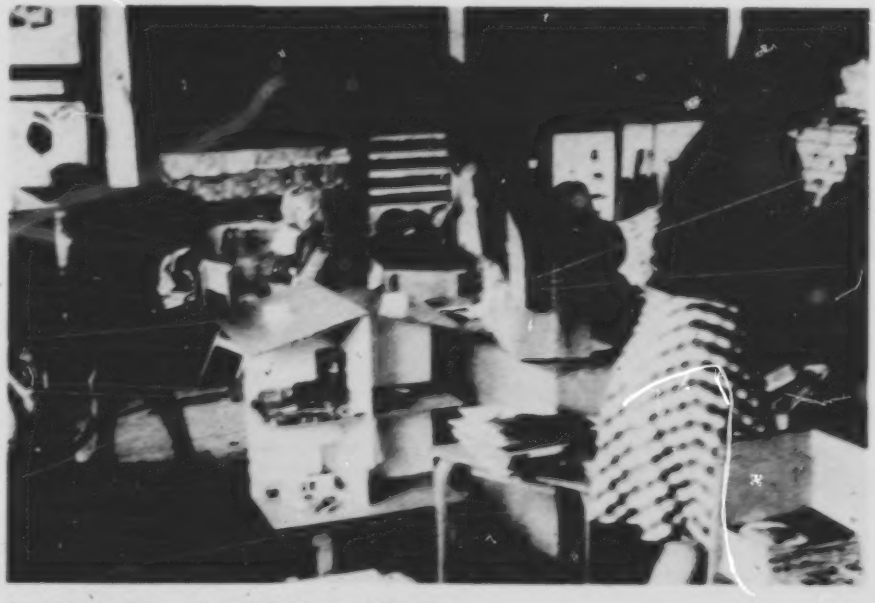
At the start of compulsory education, whether at 6 or 7 years, the pupils were generally spending most of their time in formal classrooms, sitting at single

or dual work places, with or without provision for storage incorporated, and with no other type of workplace in the rooms. Display was usually confined to pinning surfaces, rarely generous in scale. Provision for the display of books, as distinct from storing them, was rare, as were arrangements for imaginative displays of materials and objects. Sometimes there was a sink in the classroom, but when tucked away in a corner or poised on a spotless carpet, there was not much encouragement to make use of it, particularly when not complemented by the necessary craft tables, worktops and tools.

In some rooms there were single or dual tables arranged in groups more informally, but this did not necessarily indicate a change in teaching and learning methods. Nor, indeed, did the large arays of informal table groups in extensive open areas. Though such spaces might give the impression that a significant educational change was taking place, in reality it would generally appear that only the range of group sizes had been extended, not necessarily the range of educational opportunity.

Specific study of different subjects increased as pupils moved up the school, but in separate "subjects rooms", which were equipped for crafts, or for science for instance. In other words, the traditional secondary school methods had been accepted, possibly without question, for these middle age-range pupils, rather than a logically planned development of the more integrated ways of working common in many schools for younger pupils.

Thus the furniture, both in the classrooms and in the separate subject rooms, appears to have remained largely unchanged from what has long been familiar in secondary schools generally, and the separation of one kind of work from another was probably caused more by problems associated with the provision of specialised items of furniture and equipment than by educational principles. Figure 9 illustrates diagrammatically those types of rooms most commonly encountered. Actual examples of the furniture arrangements in them are given in Appendix IV, in which two of the projects are discussed.



Grantchester Primary School (5–11 years), Cambs
The classroom originally designed for pupils doing the same (mainly sedentary) work at the same time has become inadequate both in space and variety of furniture as activity and groupings have become more diverse.

THE EDUCATIONAL AIMS OF THE PROJECTS

Both the central and local authorities concerned with the selected projects expressed their intention of designing and furnishing schools to promote educational changes. It was clear that one main objective was to weaken the polarity between what in England would be described as the primary mode and the secondary mode, or between topic work and subject work, by means of a gradual rather than a sudden differentiation of the curriculum. In other words, to achieve an educational process right through the age range from pre-school up to 13 or 14 years which would be one of gradual and consistent development.

The planning implications of these proposals were visualized as an enrichment of the "local" class bases, introducing more variety of space, furniture and equipment, more varied scale and character, and opportunities for different sizes of working groups. There would consequently be a diminution in the number and nature of special subject rooms. These implications were agreed in principle, but circumstances imposed constraints. For example, one project involved the adaptation of an existing building; in other, the construction of a new school had already started, thus limiting the scope for planning modifications which were implied by the educational proposals. (Had these modifications been made, the projects would in all probability have been less acceptable to the teachers, who were still obliged to meet the existing curriculum requirements which those wanting to promote change were not empowered to alter.) Appendix IV illustrates the ways in which the projects evolved.

It would be unreasonable, however, to expect major changes initially. If a way forward has been clarified, particularly the need to match the eagerness for change with the authority and means of achieving it, the projects will have served a useful purpose. Their influence may be more important than their initial achievement.

AN EDUCATIONAL BASIS FOR CHANGE

It may be helpful to state, in the simplest terms, the educational assumptions which underlie the changes that have been discussed.

Children learn at different speeds and in different ways; therefore work tends to be planned for individuals and for small groups rather than for class units. Social and emotional factors affect a child's ability to learn; therefore the situation at home and the attitude of parents are the teachers' concern. This suggests, particularly during the early years a domestic rather than an institutional character in the school, which thereby becomes a place where parents can feel at ease, in which space and furniture encourage an atmosphere of informality, and where cooperation between teachers, parents and children is fostered.

Children's intellectual development during their earliest years is fundamental to subsequent development and is brought about by using mental processes through observing, selecting, comparing, discovering. Facts and information are more securely acquired and understood through these processes than by memorising by rote. Intellectual development depends on first hand, real experiences of many kinds, which teachers and children share with each other.

The character of spaces will not therefore be formal, institutional or prestigious, but in a workmanlike way will present a rich variety of "starting points". Some spaces will be small and intimate; some will be larger, some will be quiet and others will be noisy; some will be clean for delicate work, others for rough or messy work. Different activities are likely to be going on simultaneously, group sizes will vary, and a very wide range of materials and resources will be in use. Many of these will not emanate from the authority, but will be unpredictable, because enterprising teachers will on their own initiative take advantage of local opportunities. Work is not likely to be rigidly divided between the active and the sedentary, nor between book work, writing work and practical work. Each will reinforce and follow on from the other. It is likely that, increasingly, the pattern of activity will be determined by teachers' own decisions, rather than by a curriculum, timetable and procedures governed by an authority which is remote from the life of the school.[2]

The diagrams presented in Figures 10–14 are an attempt to clarify some of the principles of design which result from such an educational basis. Figure 10 analyses the "ingredients" of planning which seem to replace the formal classroom, and assembles these into local "centres", varying in size and arrangement. Figures 11 and 12 show a new school designed on these principles. And Figures 13 and 14 illustrate how an old school with

formal classrooms was converted in response to educational change.

Similar principles apply both to the younger and the middle age ranges. But as the curriculum becomes more diversified, work in the local centres, while continuing to cover a wide spectrum of the curriculum, is supplemented by work in other places which are shared by everyone, and are equipped with tools and apparatus too costly or specialised in many instances to be provided in each local centre. These "other places", however, are not all likely to be separate subject rooms, fully time-tabled for formal class groups. They will be more broadly based and pupils will come to them in varying numbers and for varying periods of time, according to the stage reached in a particular piece of work. Also, the relationship between work done in these shared spaces and in the local centres will be enhanced by the cooperation and interchange between teachers in both. Figure 15 indicates this in principle, and in Figures 16–19 some actual examples are shown.[3]

These educational assumptions and their implications have been made more explicit than they were in discussion during the course of the projects, and the report extrapolates for the possible benefit of readers to whom the plans in Appendix IV will appear to a degree to be compromises, in which the reality may obscure the principle and aim. However, had not such educational principles been implied in the projects, furniture development work in them would have been deprived of educational content, and thereby restricted to technical matters—which would have diverted attention from the kind of furniture really needed. This is not to deny the importance of technical development, particularly when it combines higher quality with lower cost. But designers are often preoccupied by appearance, to the detriment of performance—in which case teachers tend to feel more at home with their own improvisations than with new furniture.

Part One has been concerned with educational change and development. The consequences for the design and supply of furniture are discussed in Parts Two and Three.

NOTES

1. *A Right to be Children : Designing for the Education of the Under fives*, RIBA Publications Ltd., Londres, 1976.

2. Torvald Slettebø *Liv og Laering i Åpne Skoler*, Forsøksrådet for Skoleverket, Oslo, 1971.
Dans ce petit livre l'auteur donne, sous forme de commentaires à plus de 250 photographies prises par lui-même, une image très vivante de l'enseignement primaire, pleine d'humour et de finesse. Les relations entre l'enseignement, l'apprentissage, l'environnement et le mobilier sont intimement imbriquées.

3. a) *Building Bulletin 53*, "Guillemont Junior School", HMSO, Londres, 1976.
b) *Building Bulletin 35*, "New Problems in School Design: Middle Schools: Implications of Transfer at 12 or 13 Years", HMSO, Londres, 1966.
c) *A & B Paper No. 3*, "Delf Hill Middle School", Architects and Building Branch, ministère de l'Education et de la Science, Londres, 1978.

Figure 1 MAIN ZONES OF ACTIVITY (Younger Age Range: Pre-School)

The work and play of very young children can be divided into about seven categories. Indoors, the definition of these zones is mainly by the arrangement of furniture, but appropriate surfaces are also important (for example in zone 4 for messy work involving clay, water, etc; and for quiet bookwork and story-telling in zone 5). Height is important for moving and climbing.

Burswood Nursery School (3½–5 years), Stoke
An example of table work activity for which a close standing height table is required.

Weir Nursery School (3½–5 years), Stoke
An example of table work for which a large sitting height surface for messy work is required (messy acting can be seen in the background).

Long Eaton Nursery and Infants School (3½–7 years), Derby CC
Acting. A hospital has been set up in the window bays whose wide sills are valuable for many reasons.

1
TABLE WORK — eg. using materials & objects - not making much mess - small scale

2
ACTING — eg. home play - camping - shops - hospitals

3
MUSIC — eg. exploring sounds individually, singing & dancing together

4
MESSY — eg. using clay, water, sand etc.

5
QUIET WORK — eg. looking at books, writing, resting, story telling

6
MOVING — eg. climbing, swinging, jumping, rolling

7
CONSTRUCTION — eg. building with blocks, small & large scale, undertakings such as engines, buses, boats, houses, etc.

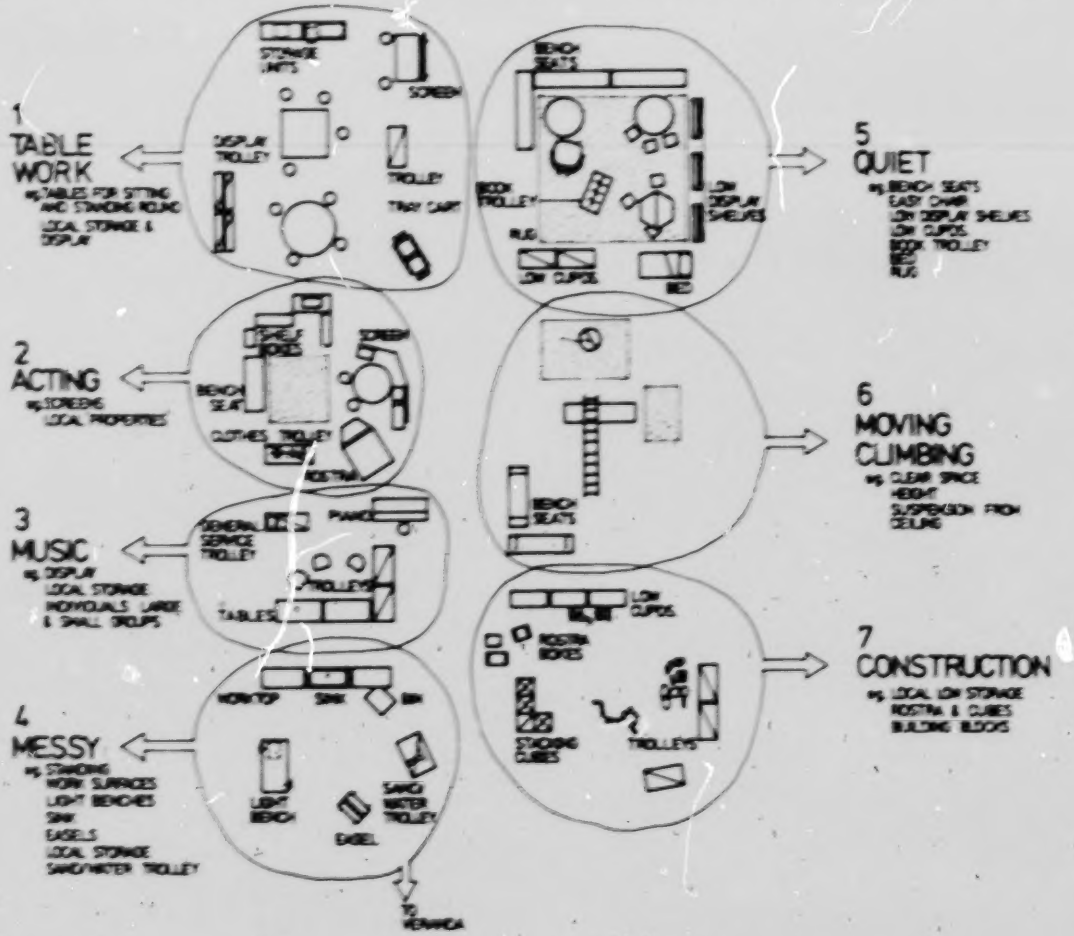
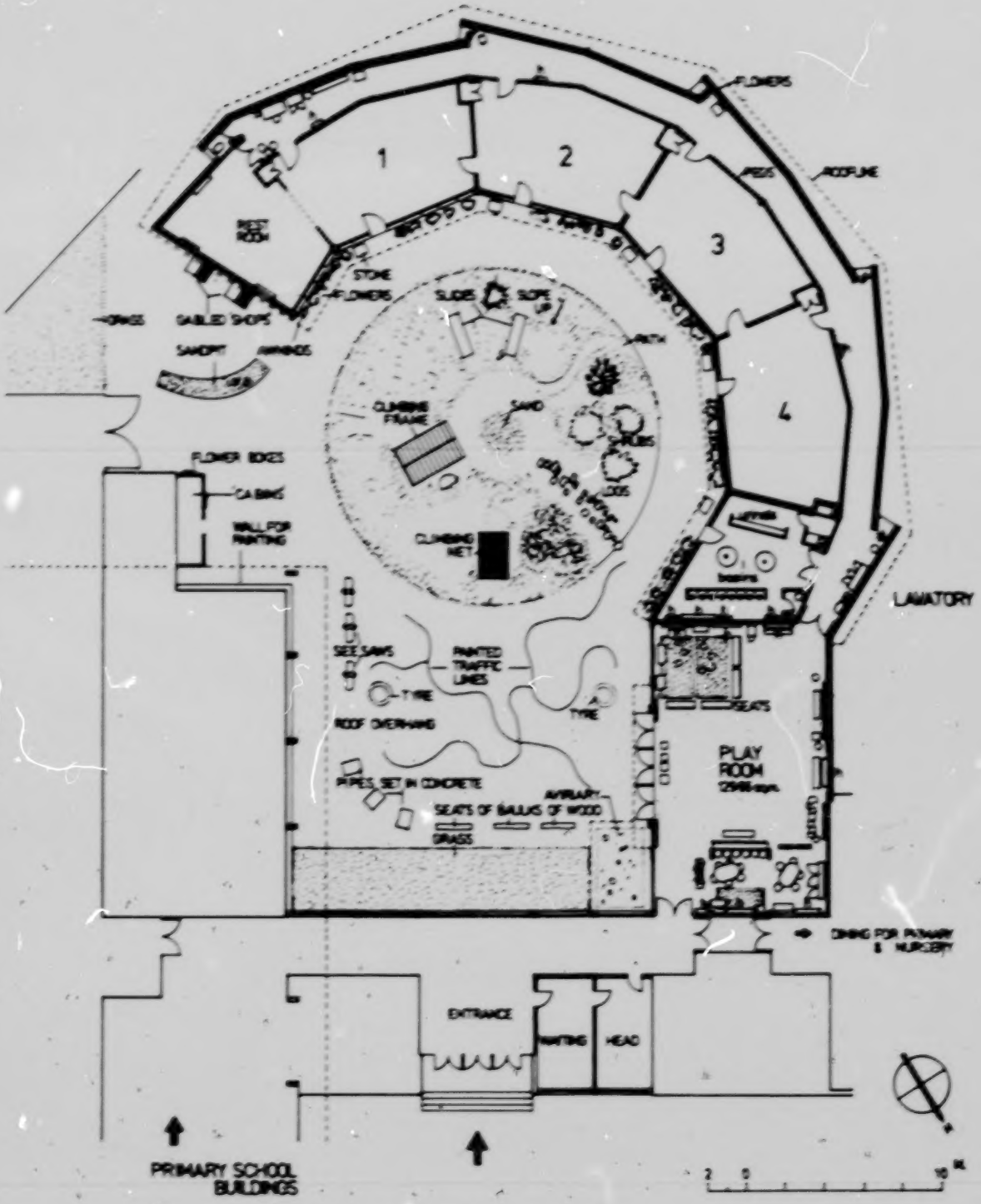


Figure 2 PLAN (Pre-School)
Ecole maternelle des Cébrades, Périgueux

This urban school was designed for 140 pupils, in four classes of 35, and was added to an existing elementary school in 1972. At the time of the visit in 1976 there were 89 pupils on roll.

The total working area would have given 2.76 sq.m per pupil at 140 pupils, but only 1.57 sq.m per pupil in each classroom. In fact, with the smaller numbers, the classroom areas were more generous.

The large shared playroom was timetabled for separate classes, each class using it once or twice a day for 15–20 minute periods. A striking feature of the design was the grouping of the classrooms round the play garden which was imaginately designed, planted and equipped with the help of parents. Awnings over the classroom windows provided shade and shelter when required and a link between indoors and outdoors. This offered a stimulus for learning and play in a form that successfully expressed a community that could enjoy a sense of adventure with a feeling of security.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ROOF LINE
STONE
FLOWERS
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SAND
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CABINS
WALL FOR PAINTING
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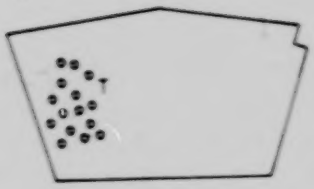
PAINTED TRAFFIC LINES
TYRE
TYRE
ROOF OVERHANG
PIPES SET IN CONCRETE
AVIARY
SEATS OF BALUSTRADE OF WOOD
GRASS
LAVATORY
SEATS
PLAY ROOM
DOOR
DOOR
DOOR FOR PRIMARY & NURSERY
ENTRANCE
WAITING
HEAD
PRIMARY SCHOOL BUILDINGS

23

Figure 3 ROOM FOR CHILDREN 2½–3 YEARS (Pre-School) Ecole maternelle des Cébrades, Périgueux

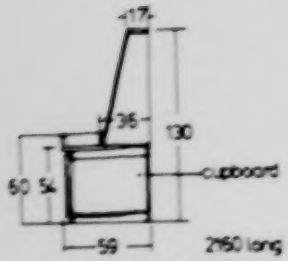
This shows the distribution of 15 pupils aged 2½–3 years at 09.20 hours with diagrams of others at different times. The variety of opportunity and activity can be clearly appreciated from the plan. There were rest beds, rugs, "modules", and normal chairs for lying and sitting.

There was a choice of horizontal work surfaces, including the floor, oblong, hexagonal and rounded tables, and wide sill worktops; and there was generous provision of sloping work surfaces mainly for painting. Each group room had a sink and direct access to the play garden. As the sketches on the drawing show, the furniture—which extended beyond tables and chairs, i.e. for storage, display and practical work—was of a "home-made" nature. The "module" referred to above and indicated on each of the four group plans is illustrated in Figure 6. It was a versatile unit designed locally at the instigation of the Inspectrice.



09.30 hrs 15 pDN CARPET
0940 - ROOM EMPTY

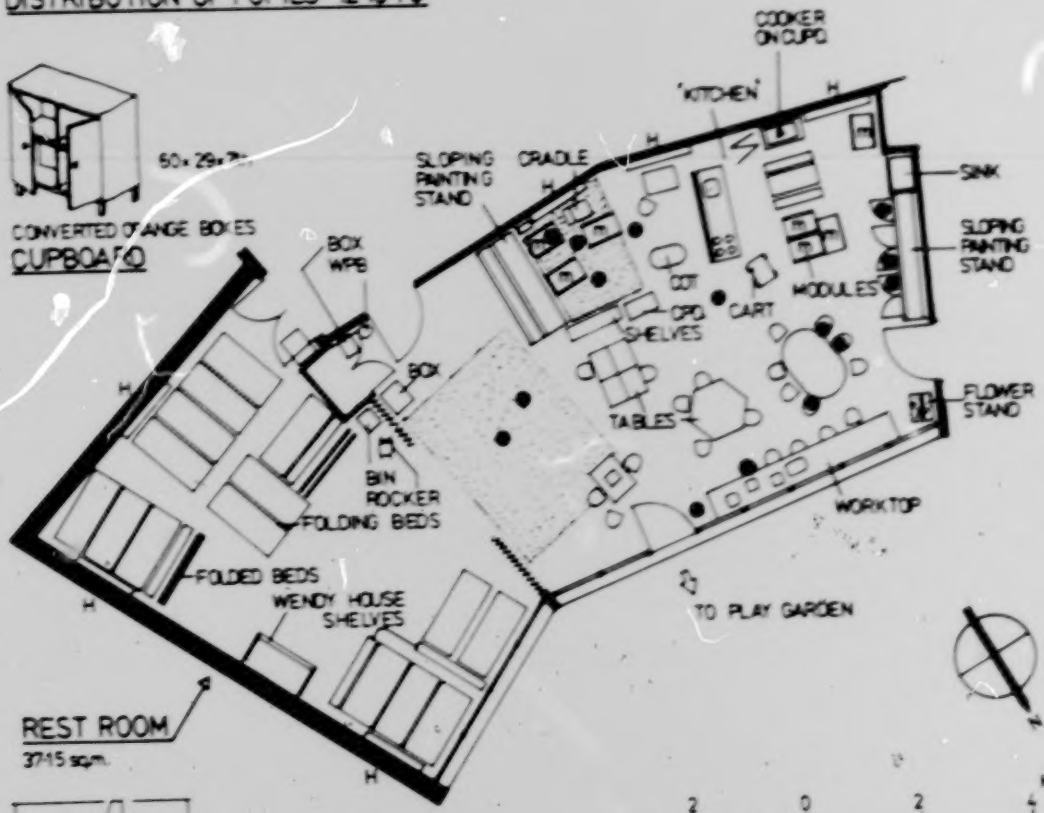
0920 hrs 15 pAS BELOW



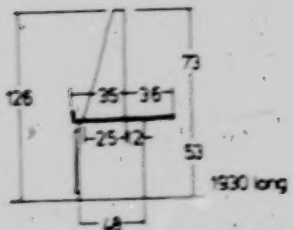
PAINTING STAND

DISTRIBUTION OF PUPILS 12-10-76

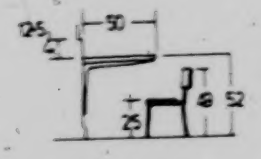
CONVERTED ORANGE BOXES
CUPBOARD



REST ROOM
37.15 sq.m.



PAINTING STAND



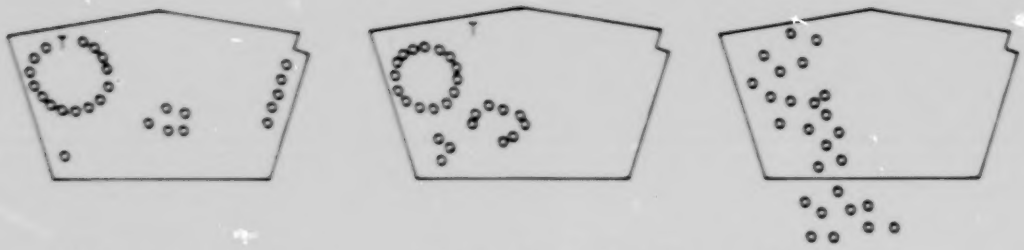
WORKTOP

Figure 4 ROOM FOR CHILDREN 3–4 YEARS (Pre-School)
Ecole maternelle des Cébrades, Périgueux

This shows the distribution of 26 pupils at 10.00 hours (and three other groupings). Of particular note are the three improvised enclosures:

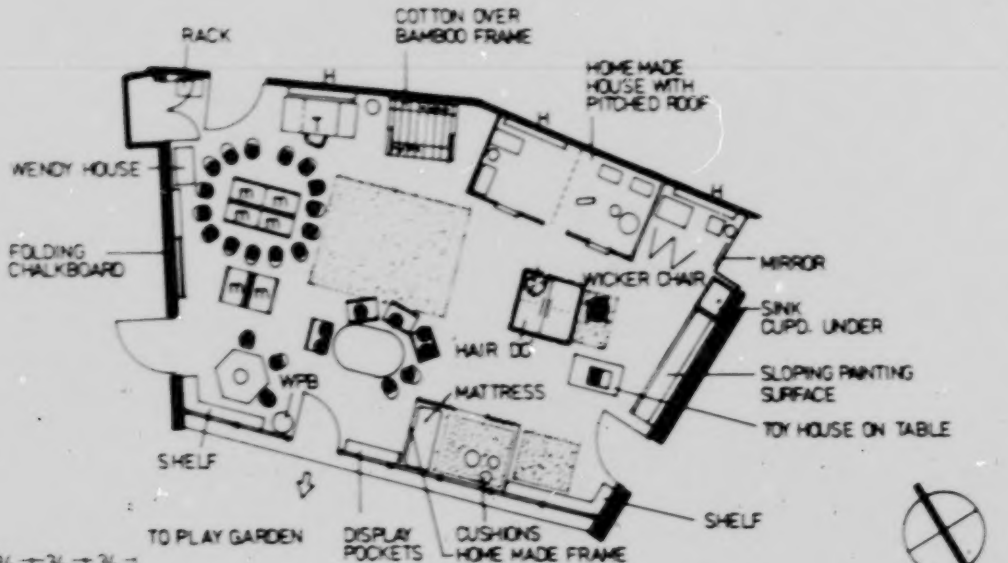
- the cotton-covered bamboo frame;
- the house of cardboard and canvas, with a pitched roof;
- the four standard classroom tables skilfully "dressed" and provided with mirrors and a wicker chair from a local market, forming a "hair-do" set-up.

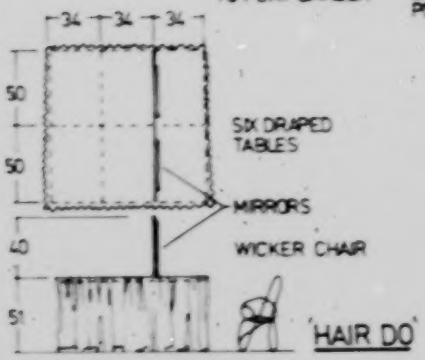
Of a different—and inappropriate—character was the very large folding chalkboard on an aluminium frame.



0945 hrs. 26p. 1000 hrs. 26p. (MILK BREAK) 1010 hrs. 26p.

DISTRIBUTION OF PUPILS 12-10-76





'HAIR DO'

Figure 5 ROOM FOR CHILDREN 4–5 YEARS (Pre-School) Ecole maternelle des Cébrades, Périgueux

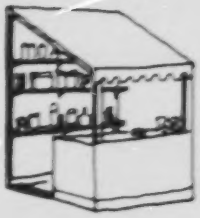
This shows the grouping of 22 pupils at 10.35 hours (and two others later in the morning). For these older pupils (4–5 years) the layout was more regular, but a similar scope of activity was provided for, with two domestic play zones and a well arranged focus for discussion on the rug surrounded by matresses and cushions. The original of the "shop" was home-made, but proprietary versions later became available.

Ecole maternelle (2–8 years), Périgueux
This homeplay area (acting) has been carefully arranged by improvised means. (The room layout was recorded 3 months after the photograph was taken).

1035 hrs. 22p.

1050 hrs. 22p.

DISTRIBUTION OF PUPILS 12·10·76



100 x 100 x 166–115h.
CANVAS TOP, WALLPAPERED COUNTER

'SHOP'

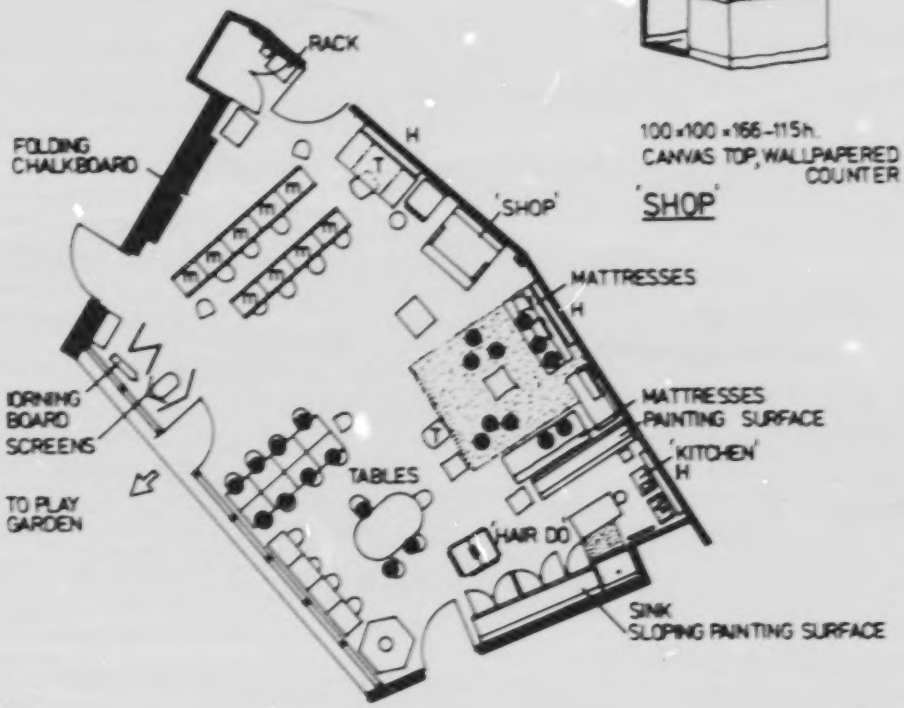
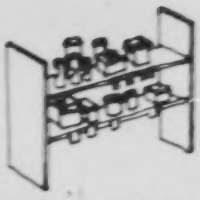
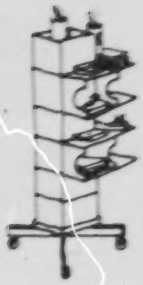


Figure 6 ROOM FOR CHILDREN 5–6 YEARS (Pre-School)
Ecole maternelle des Cébrades, Périgueux

This shows the layout observed for 28 pupils. The drawing shows some of the very simple but effective home-made display items. (The proprietary "rack" was less useful.)

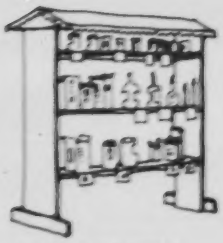


PAINTED SOFTWOOD
100 x 29 x 80h.
'SHOP' DISPLAY

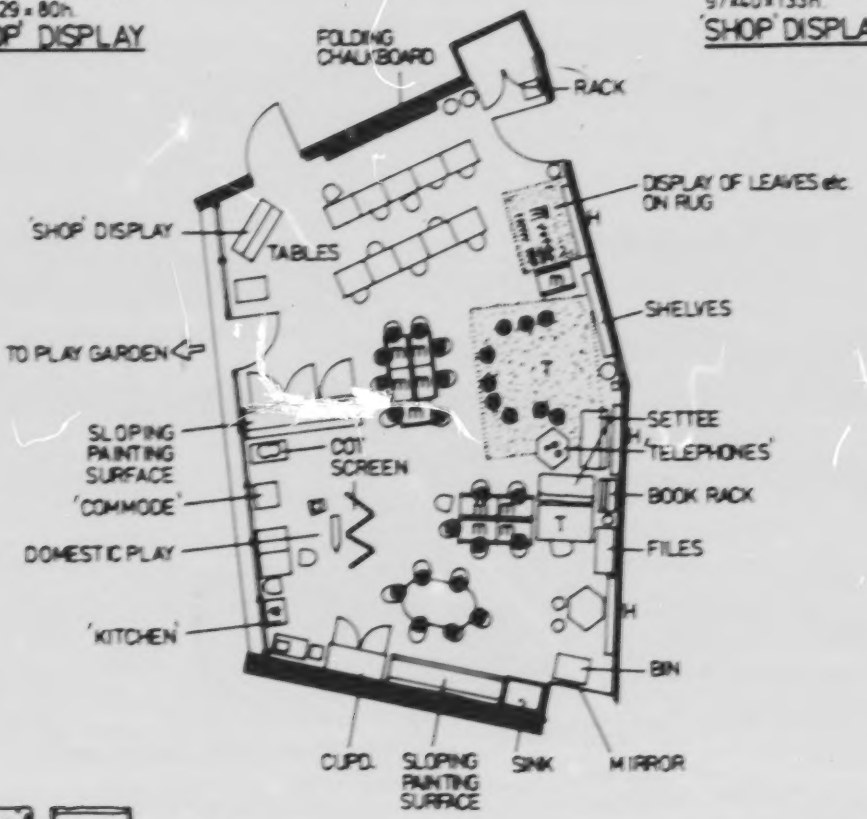


STACKING PLASTIC
UNITS 24x24
overall 125

MOBILE RACK



CANVAS CANOPY
97 x 40 x 133h.
'SHOP' DISPLAY

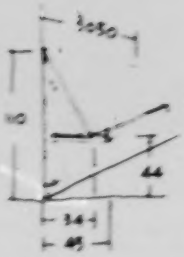


THE 'MODULE'

Figure 7 IMPROVISATION IN A VILLAGE HALL (Pre-School) La Roque Gageac, Dordogne

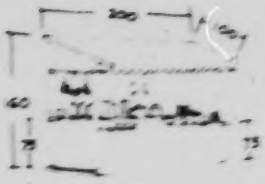
This shows a village hall which was temporarily occupied by a group of about 20 pre-school children while an old primary school was being converted for them. Almost all the furniture was either second-hand or home-made for the time being. The area per pupil was as high as 5 sq.m.

It is important to observe and record the improvisations of teachers in any circumstances, because these are a direct expression of their needs and are often a measure of the gap between what is wanted and what the "system" provides. Moreover the improvisations are usually made by enterprising teachers from whom there is most to learn. In this plan, different "zones" have been created for the storage of coats and bags, for acting, for painting, and for small groups around a chalkboard.



HOME MADE PAINTING STAND

CONVERTED DUAL SHELF DESK



HOME MADE 'SHOP'

CONVERTED CHALKBOARD

EXAMPLES OF IMPROVISED FURNITURE

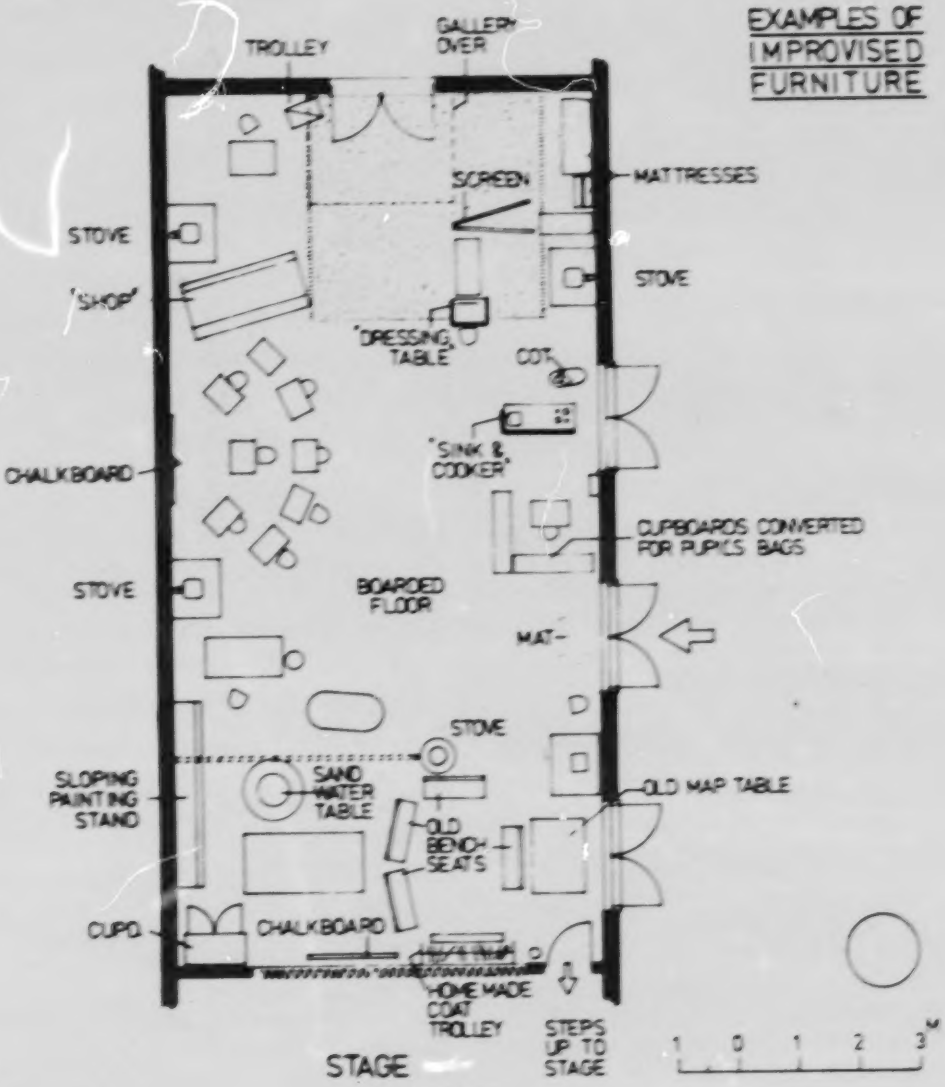
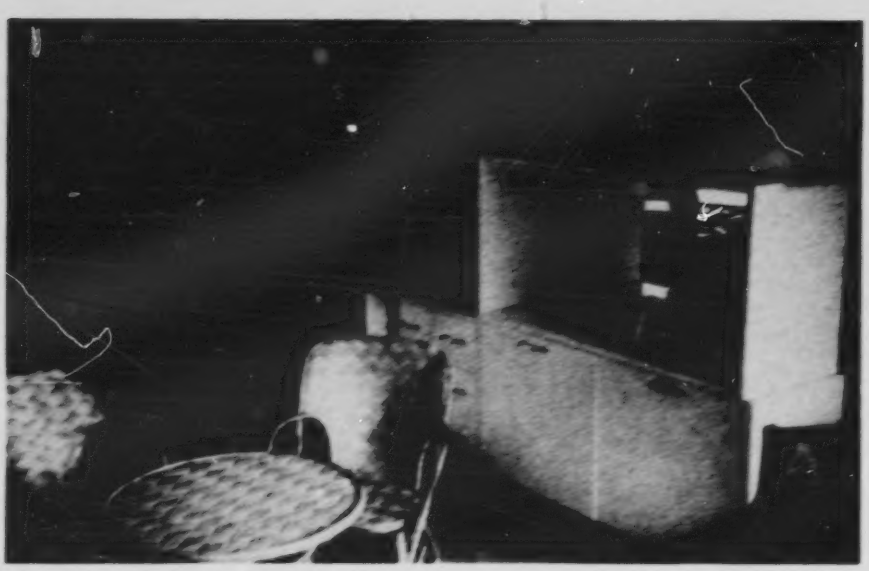


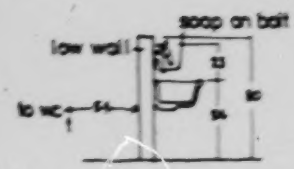
Figure 8 PLANS AND FURNITURE (Pre-School)
Ecole maternelle du Lys, Périgueux

This school designed for 140 pupils in four groups opened in the summer of 1976 and was visited in October of that year. The total working area was about 3.9 sq.m per pupil at 140 pupils. It was designed on two levels; at ground level a series of interlocking hexagons and below a large dining room and kitchen.

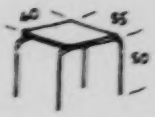
The youngest group had three of the hexagons—one carpeted, one with vinyl floor for play and a rest room. The other three groups had two hexagons each—one carpeted and one for "practical activities" and play. In addition there was a room for dance and movement. An interesting outdoor area was being developed. A feature of particular interest in this school was the range of storage and display furniture. These units had been worked out by a group of teachers who sent sketches to local manufacturers and a technical college for estimates. They were based on plan sizes of 50 × 35 cms, 100 × 35 cms and 100 × 60 cms. Elevation sizes were 50 × 50 cms and 100 × 50 cms. The construction was of white painted chipboard. This showed praiseworthy local initiative which could benefit from technical guidance.



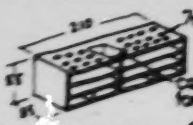
Ecole Maternelle (2–6 years) du Lys, Périgueux
These white painted particle board units were locally made on the basis of teachers' and advisers' ideas and sketches.



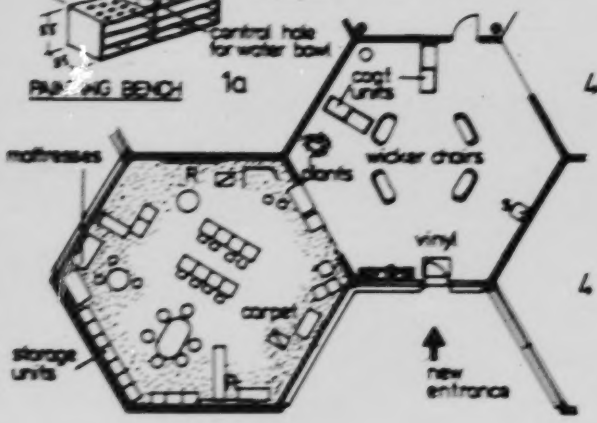
TROUGH BASIN FOR 4yrs



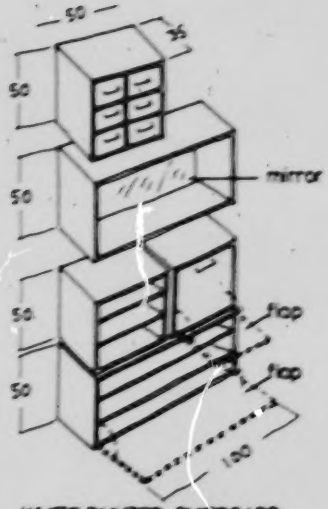
COMMON TABLE SIZE
(Chair ht. 35cm)



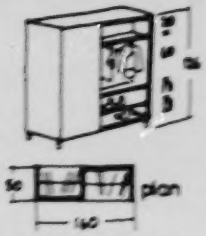
PAINTING BENCH 1a



PLAN OF ROOMS 3 & 3a

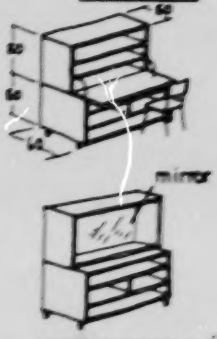


WHITE PAINTED CHIPBOARD STORAGE & DISPLAY UNITS

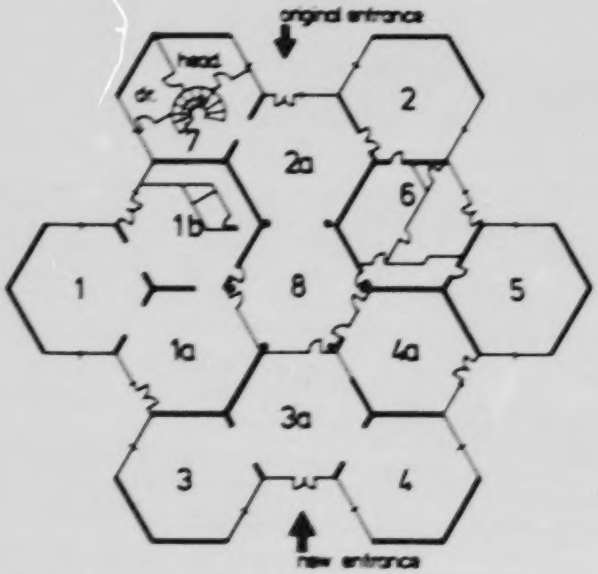


COAT & SHOE TROLLEY
(interiors too small)

SOME ASSEMBLIES



COMBINATIONS OF 60 & 50cm. DEEP UNITS



PLAN OF SCHOOL (KITCHEN & DINING UNDER 8)

1 GROUP 2yrs
1a . REST
1b . PLAY
2 GROUP 3yrs
2a . MANUAL
3 GROUP 4yrs
3a . MANUAL
4 GROUP 5yrs
4a . MANUAL
5 SALLE DE DANSE
6 LAVS
7 ADMIN
8 CIRCULATION

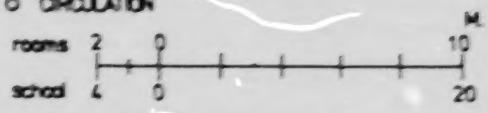
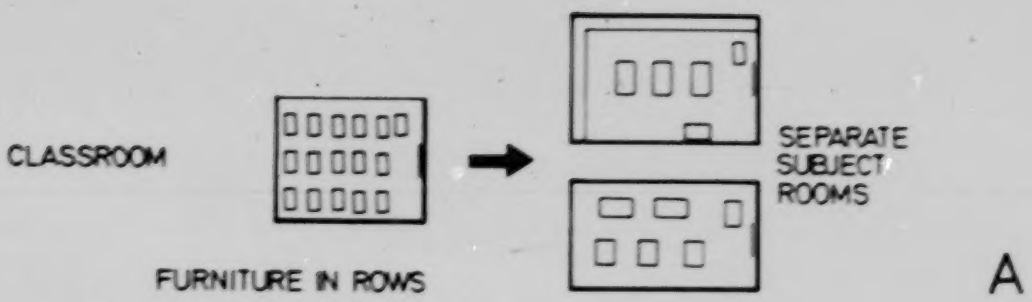


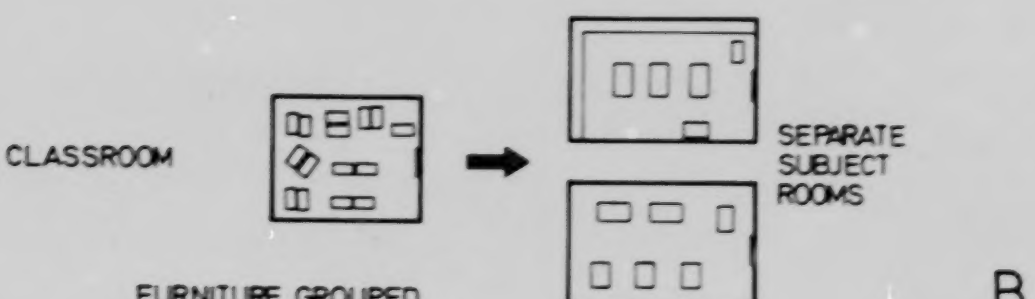
Figure 9 ORGANISATION OF WORK AREAS (General Basic School)

A Standard classrooms each with rows of desks facing the chalkboard. These rooms are equipped only for a limited range of work. Pupils go to separate subject rooms for work for which the classrooms are not equipped.

B Similar classrooms with similar furniture which is arranged in more informal groups. But this does not in itself change the organisation of the work described above.

C The area of two or more classrooms is dissolved into larger areas which allow a variety of group sizes. But the type of furniture is unchanged educationnally. The pupils continue to go to separate subject rooms.


CLASSROOM
FURNITURE IN ROWS
SEPARATE SUBJECT ROOMS
A


CLASSROOM
FURNITURE GROUPED
SEPARATE SUBJECT ROOMS
B

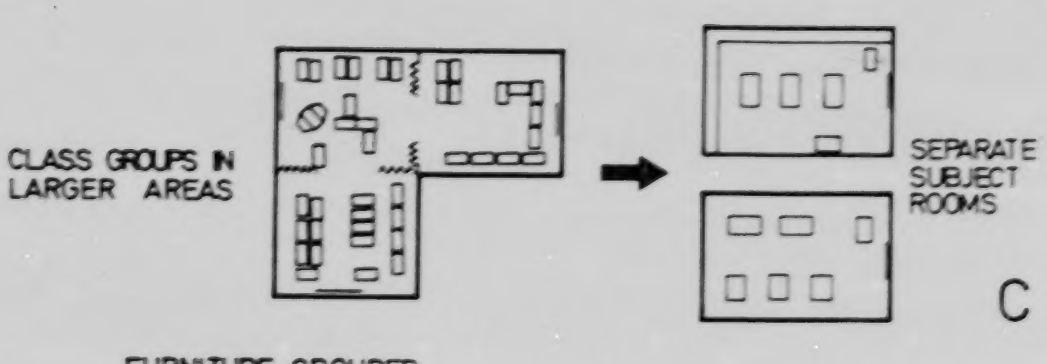

CLASS GROUPS IN LARGER AREAS
FURNITURE GROUPED
SEPARATE SUBJECT ROOMS
C

Figure 10 LOCAL CENTRES (Younger Age Range) Assembly of Ingredients

This diagram is a simplified expression of the planning implications of an educational request for a greater range of local activity. It can—and should—be applied in many different ways according to circumstances.

The "home base" (H) is where each group can gather together with the teacher responsible. It is not necessarily designed for all to sit at tables. Smaller groups will usually work there.

The "particular bays" (P) are for small scale projects needing particular equipment such as a sink, cooker or simple scientific or mathematical apparatus. Here a piece of work can be pursued independently by an individual or small group without disturbance.

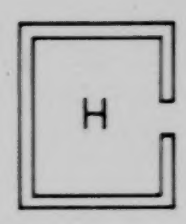
The "general work area" (G) is less specific, and can respond to changing group sizes and furniture arrangements.

The "enclosed room" (E) is for seclusion and quiet work—or alternatively where noise can be made without disturbing others.

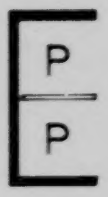
The "covered work area" (V) indicates a sheltered extension of the interior, increasing the scope of activity and linking inside and outside work.

These ingredients imply a wider range of furniture than is normally provided in a classroom, and a close association between different items. They do not represent a new type of classroom; they are "ingredients" which can be assembled in many ways to form local "centres" for two or more teachers and correspondingly more pupils.

INGREDIENTS OF LOCAL CENTRES



HOME BASE



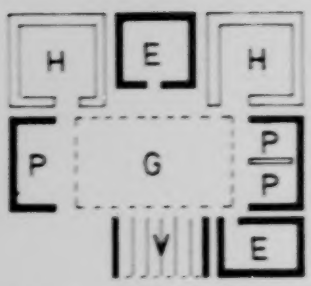
PARTICULAR BAYS

GENERAL WORK AREA

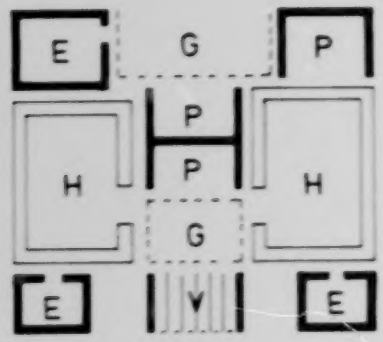
ENCLOSED ROOM

COVERED WORK AREA

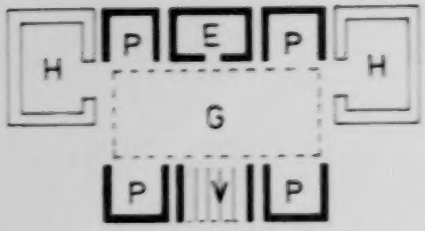
EXAMPLES OF LOCAL CENTRES



CENTRE 1



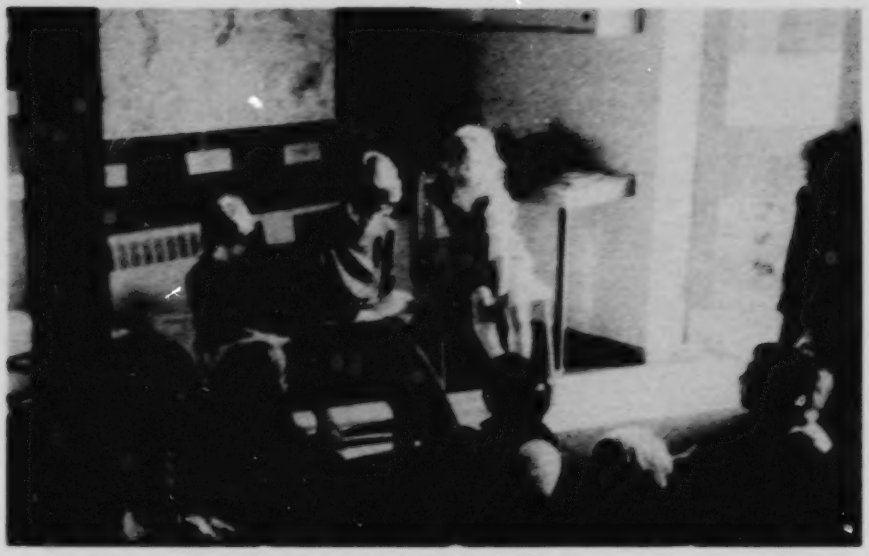
CENTRE 2



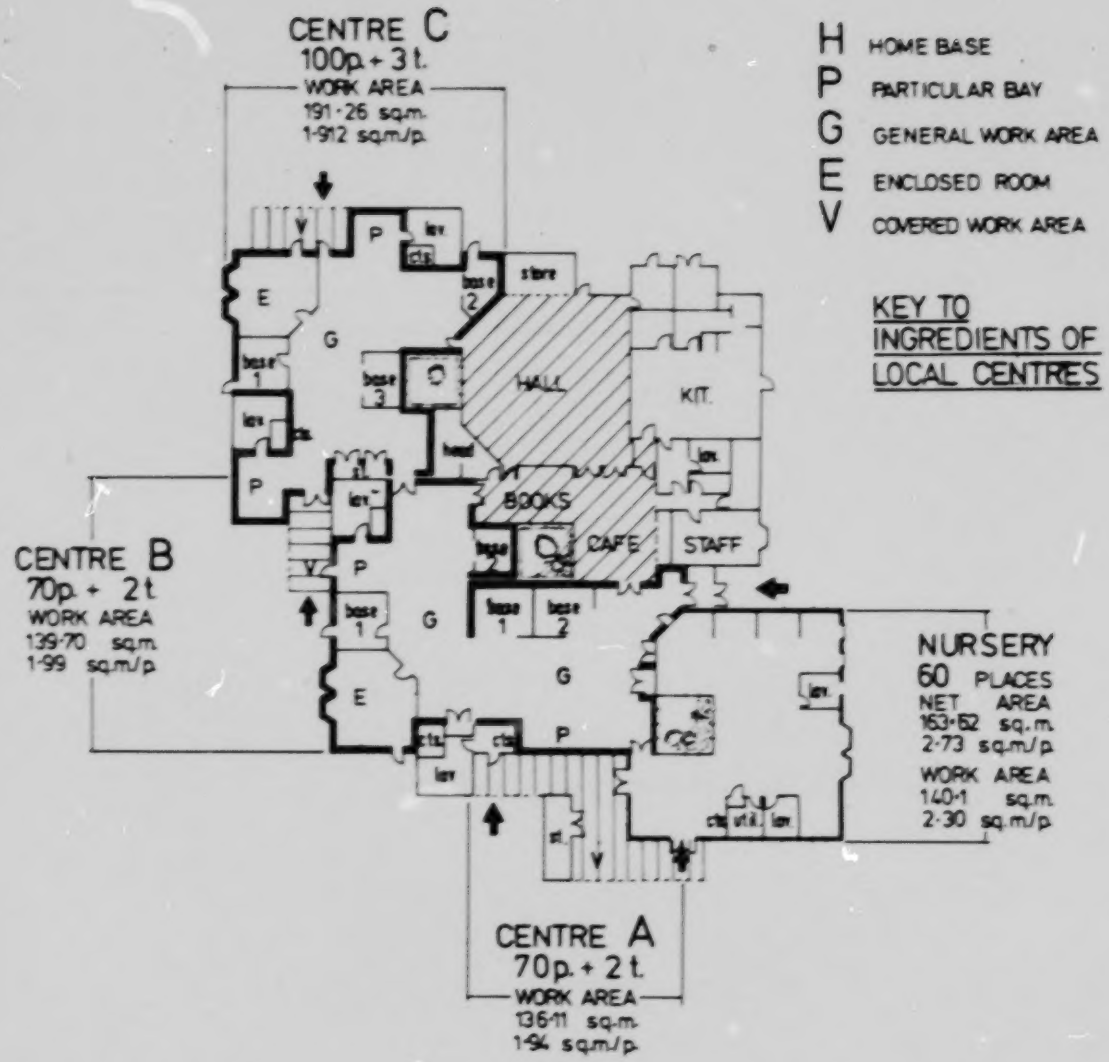
CENTRE 3

Figure 11 DIAGRAMMATIC PLAN (Younger Age Range) Parklands Infants' & Nursery School, Long Eaton, Derby

A diagrammatic plan of a school opened in 1977, and designed for 240 pupils aged 5–7 years, with a pre-school unit for 60 places. The are three centres: two of them (A and B) are each designed for up to 70 pupils and two teachers; the third (C) for 100 pupils and three teachers. The hatched areas (hall, books and café) are shared by all the 5–7 year pupils. Note the application of the "ingredients" which were defined in Figure 10.



Long Eaton Nursery and Infants School (3½–7 years), Derby CC
In this enclosed Home Base (No 1 in Centre B) the children can work quietly and securely with their teacher either as one group, in smaller numbers, or individually. Other parts of the Centre are designed and equipped for other activities.



ANALYSIS OF AREA

TEACHING	72·3%	ie 2·55 sq.m/p. at 240 p.
TCHNG. STORAGE	1·9	
PUPILS' ST. & SAN.	5·7	
KITCHEN	7·4	
ADMIN.	6·9	
BOILERS etc.	1·6	
CIRCULATION	4·2	
TOTAL AREA	100·0%	ie 3·56 sq.m/p. at 240 p.

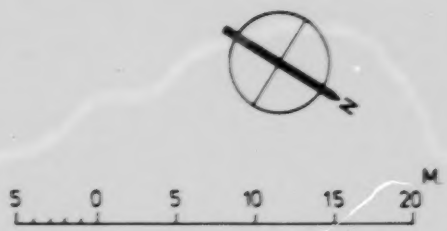


Figure 12 PLAN: FURNITURE LAYOUT (Younger Age Range) Parklands Infants' & Nursery School, Long Eaton, Derby

The plan of the school shown diagrammatically in Figure 11. The layout of the furniture shown here was observed when the school was in use, but with only 189 pupils aged 5–7 years, not the full enrolment of 240 for which it was planned.

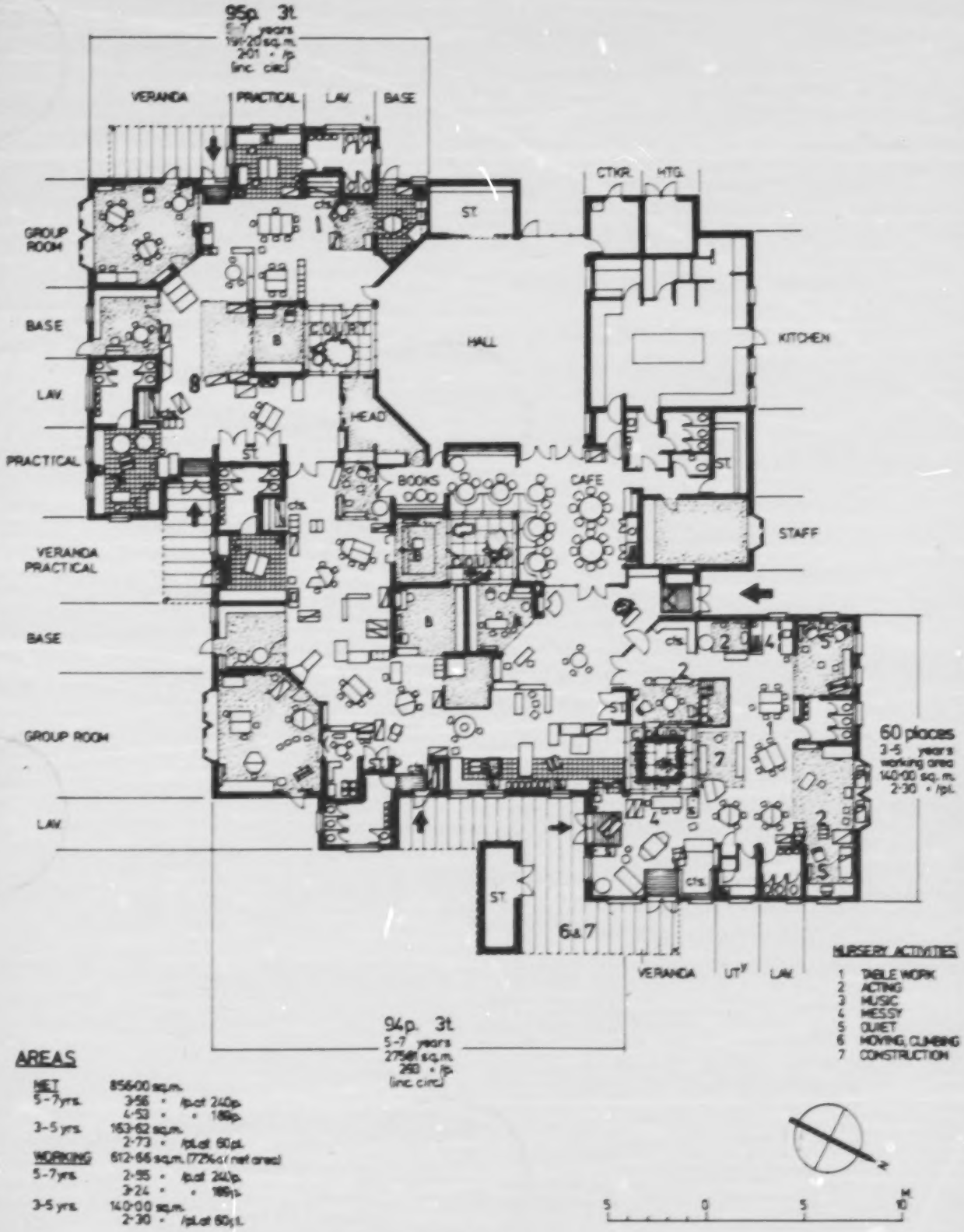
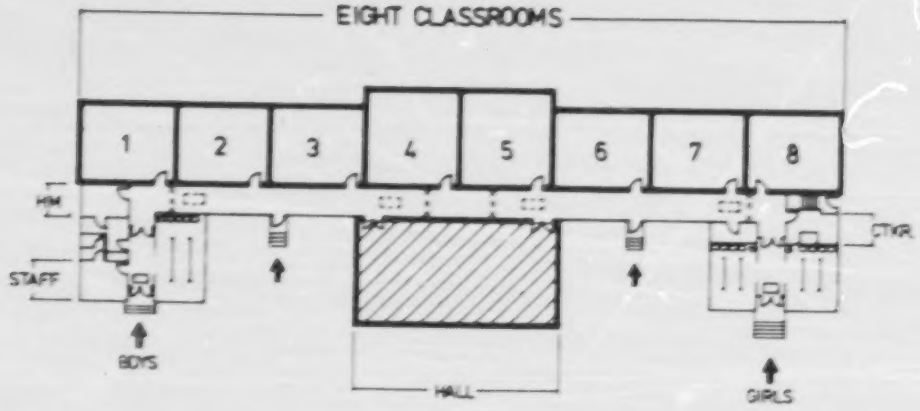

95p. 3t
5-7 years
191-20 sq.m.
2·01 • /p
(inc. circ)
VERANDA
PRACTICAL
LAV.
BASE
GROUP ROOM
BASE
LAV
PRACTICAL
VERANDA PRACTICAL
BASE
GROUP ROOM
LAV
ST
CTKR.
HTG.
HALL
KITCHEN
STAFF
BOOKS
CAFE
HEAD
60 places
3-5 years
working area
140·00 sq.m.
2·30 • /pl.
6&7
VERANDA
UTY
LAV
94p. 3t
5-7 years
275·81 sq.m.
2·93 • /p
(inc. circ)
NURSERY ACTIVITIES
1 TABLE WORK
2 ACTING
3 MUSIC
4 MESSY
5 QUIET
6 MOVING, CLIMBING
7 CONSTRUCTION
AREAS
NET 856·00 sq.m.
5-7yrs. 3·58 • /p of 240p.
4·53 • • 189p.
3-5 yrs. 163·62 sq.m.
2·73 • /p. of 60 pl.
WORKING 612·66 sq.m. (72% of net area)
5-7yrs. 2·55 • /p of 240p.
3·24 • • 189p.
3-5 yrs. 140·00 sq.m.
2·30 • /p. of 60 pl.
N
5 0 5 10 M

Figure 13 DIAGRAMMATIC PLANS (Younger Age Range) Rye Park Infants' and Nursery School, Hoddesdon, Herts

An example of an old school converted to meet educational change. The school was built in 1931 with a row of eight classrooms and a hall. In 1976 it was re-organised and adapted to provide three centres, each for 60 pupils aged 5–7 years and two teachers (i.e. a total of 180 pupils). A 60-place pre-school unit, staff accommodation and dining room were added. The hall and dining room shaded on plan, are shared.



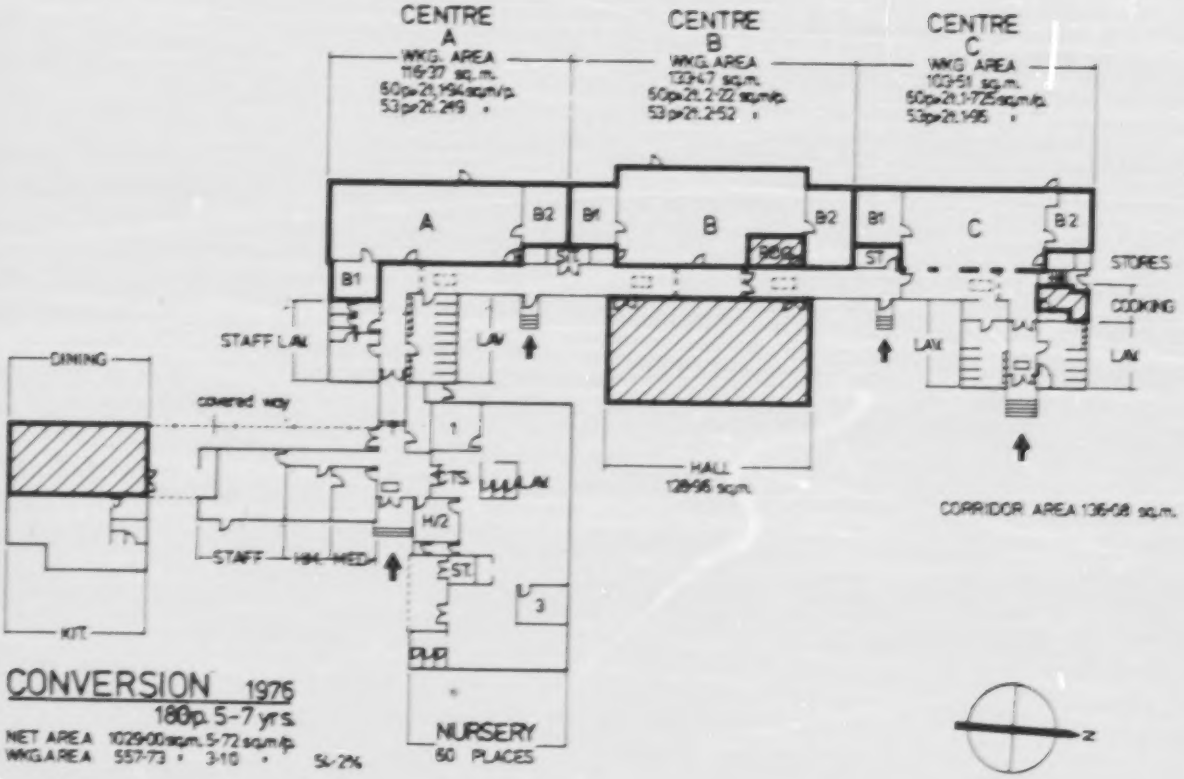
ORIGINAL PLAN 1931

320 p. 5-11 yrs. (1945-1975)

NET AREA 806·39 sq.m. 2·52 sq.m/p.
WKG. AREA 502·53 " 1·57 " 62·4 %

384 p. 5-14 yrs. (1931-1945)

NET AREA : 2·10 sq.m/p
WKG.AREA : 1·31 " "



CONVERSION 1976

180 p. 5-7 yrs.

NET AREA 102·900 sq.m. 5·72 sq.m/p.
WKG.AREA 55·7·73 " 3·10 " 54·2%

160 p. 5-7 yrs.

NET AREA : 5·43 sq.m/p
WKG.AREA : 3·48 " "

Figure 14 PLAN: CENTRE B (Younger Age Range) Rye Park Infants' and Nursery School, Hoddesdon, Herts

The layout of furniture in Centre B—see the diagrammatic plan shown in Figure 13—was recorded on a visit. Being an adaptation of an existing school, the centre does not contain all the "ingredients" defined in Figure 10, but it indicates the wider opportunities for work that have been made possible, and how the furniture arrangements provide for all manner of groupings, display and storage. In particular, the furniture defines zones for activities that could not easily be planned in this adaptation. The corridor has been furnished by the teachers as additional space for study and display.

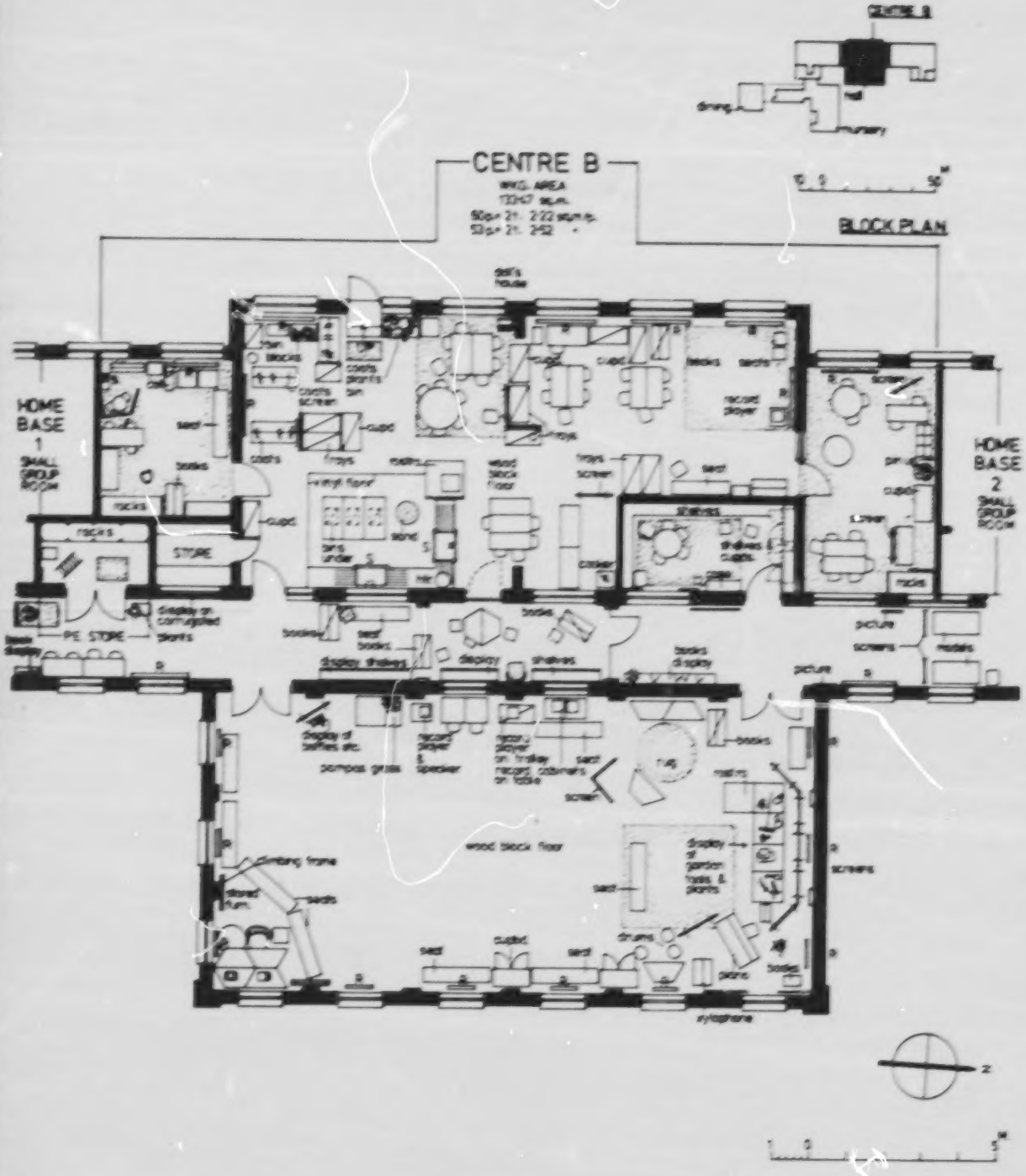

CENTRE B
BLOCK PLAN
HOME BASE 1 SMALL GROUP ROOM
HOME BASE 2 SMALL GROUP ROOM
STORE
PE STORE
wood block floor
xylophone

Figure 15 AREAS FOR WORK (Middle Age Range) Local and Supplementary

This diagram indicates how the total working area in a school for pupils of the middle age-range can be organised. Similar principles apply both to the younger and middle age-ranges, but as the curriculum becomes more diversified, work in local centres is increasingly supplemented by work in other spaces shared by everyone, as described in the text.

Heaton Middle School (9–13 years), Bradford
Part of a local centre which is planned and equipped for most of the work in the curriculum. Note the standing and sitting height work surfaces and the various means of providing 2 and 3 dimensional display.

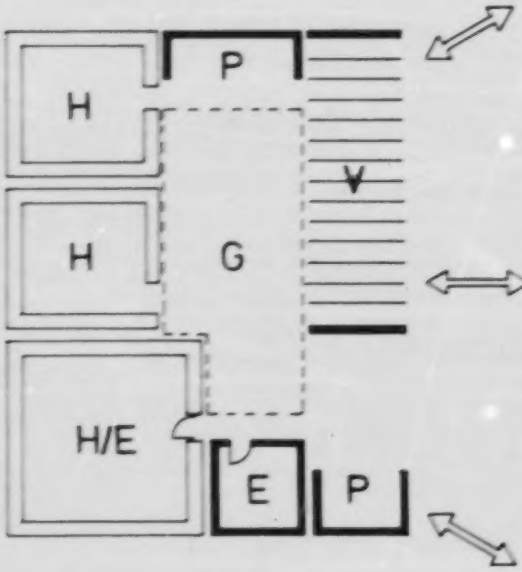
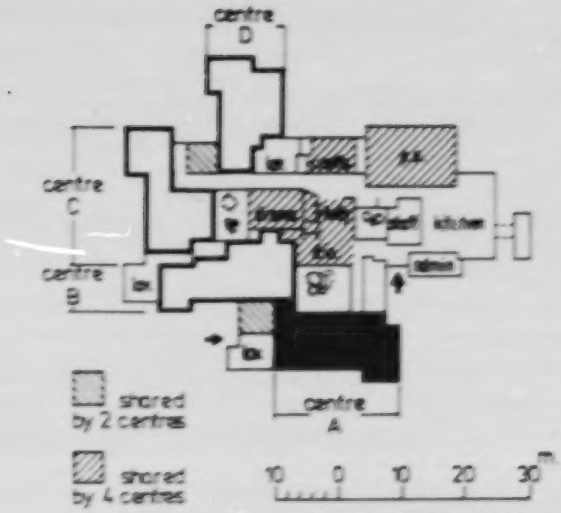
LOCAL CENTRES	SUPPLEMENTARY AREAS SHARED BY ALL CENTRES
	BOOKS & RESOURCES
	CRAFTS & SCIENCES
	PHYS. EDUC. DRAMA
	MUSIC

Figure 16 A LOCAL CENTRE (Middle Age Range) Guillemont Junior School, Farnborough, Hants

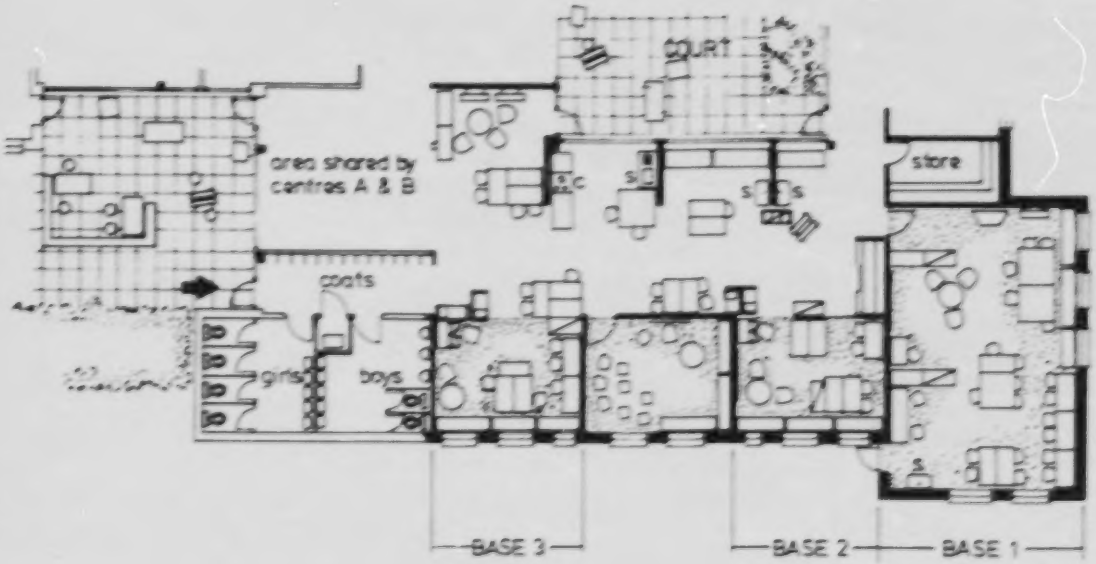
One of the four centres, designed for about 100 pupils and three teachers, in a school for 400 pupils aged 7–11 years.[3] The "ingredients" in centres for this middle age-range are similar to those for younger pupils, but are developed and furnished for a wider range and depth of work. One of the "home bases" is enclosed, and similar in size to a normal classroom. The other two are smaller, as is the second "enclosed room". The "particular bays" and the "general work area" are equipped with light services, craft tables and mobile items of furniture.

TEACHING	64·6%	ie. 2·53 sq m/p at 400 p.
TCHG. STORAGE	4·0	
PUPILS' ST. & SAN.	7·1	
KITCHEN	7·2	
ADMIN.	6·6	
BOILERS etc.	1·7	
CIRCULATION	8·8	
TOTAL AREA	100·0%	ie 4·07 sq m/p at 400 p.

ANALYSIS OF AREA



KEY PLAN

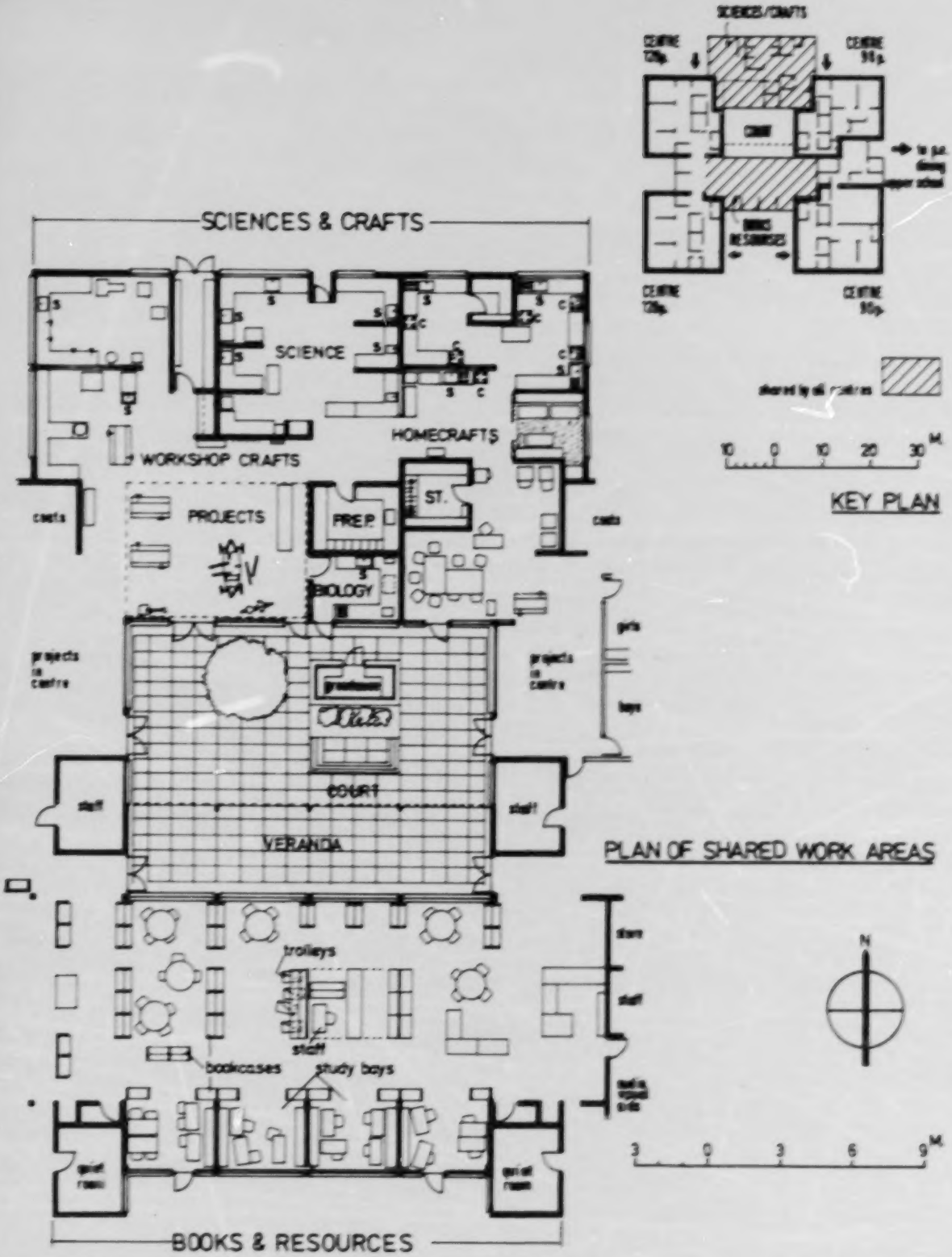


PLAN OF CENTRE A

179·74 sq m. ie. 1·79 sq m/p at 100p.

Figure 17 SUPPLEMENTARY WORK AREAS (Middle Age Range) Lower School, Joseph Whitaker Comprehensive School, Rainworth, Notts

An example of supplementary work areas, shared by four local centres as shown in the key plan. This is a separate unit of a comprehensive school, designed for 420 pupils aged 11–13 years. The shared work areas are not in the form of separate subject rooms; they are more broadly based, as described in the text.

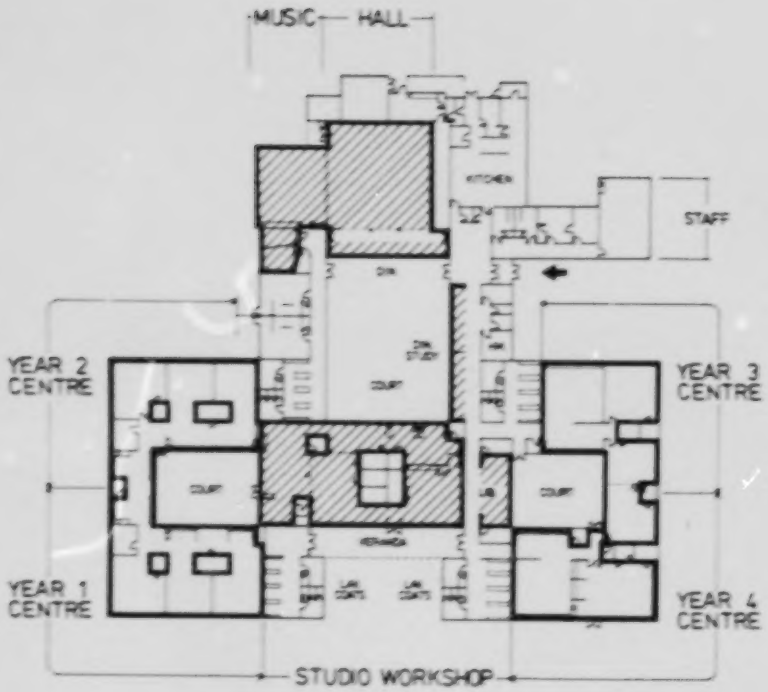

SCIENCES & CRAFTS
SCIENCE
HOMECRAFTS
WORKSHOP CRAFTS
PROJECTS
PREP.
ST.
BIOLOGY
COURT
VERANDA
staff
trolleys
bookcases
study bays
BOOKS & RESOURCES
KEY PLAN
PLAN OF SHARED WORK AREAS
N
10 0 10 20 30 M
3 0 3 6 9 M

53

Figure 18 DIAGRAMMATIC PLAN (Middle Age Range) Delf Hill Middle School, Bradford

A school designed for 420 pupils aged 9–13 years, and opened in 1967. The organisation of the school is shown diagrammatically. There are four local centres—one for each year group of about 105 pupils with three teachers responsible for their care (but others are also involved with their work). Each day the pupils work partly in their local centres and partly in the supplementary shared areas or out of doors.

Delf Hill Middle School (9–13 years), Bradford
The area designated 'studio workshop' supplements the local centres and includes spaces for domestic subjects for which this is one bay.


MUSIC
HALL
KITCHEN
STAFF
YEAR 2
CENTRE
YEAR 3
CENTRE
YEAR 1
CENTRE
YEAR 4
CENTRE
STUDIO WORKSHOP

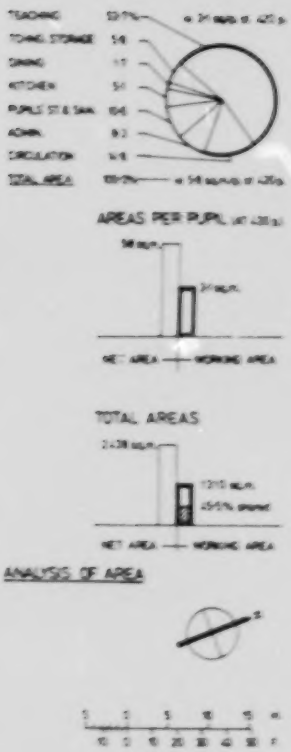

AREAS PER PUPIL
TOTAL AREAS
ANALYSIS OF AREA

Figure 19 PLAN (Middle Age Range)
Delf Hill Middle School, Bradford

The plan of the school shown diagrammatically in Figure 18, with the furniture arrangements noted when in use in December 1973.

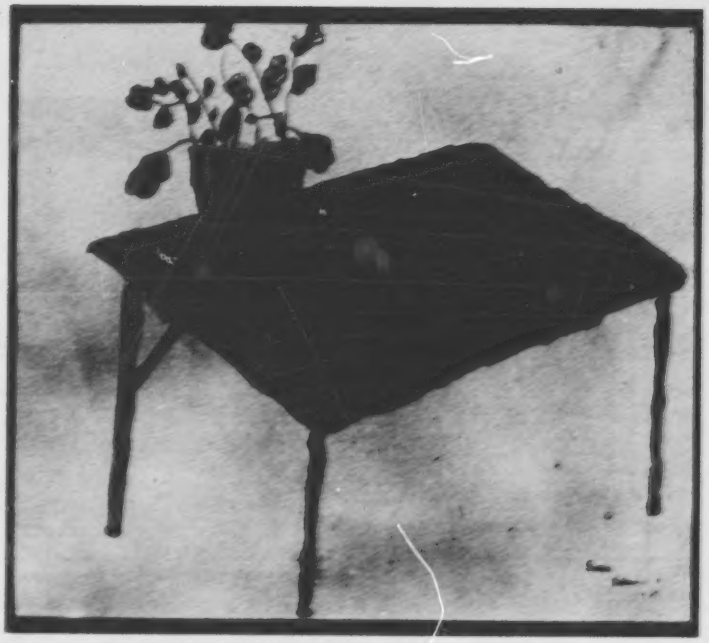
KITCHEN
MUSIC
HALL
STAFF
CHANGING ROOMS
LANGUAGES
YEAR CENTRE 2
YEAR CENTRE 3
YEAR CENTRE 1
YEAR CENTRE 4
VERANDA
STUDIO WORKSHOP
SCIENCE

Part Two:

SCHOOL FURNITURE CHARACTER AND CHARACTERISTICS

Fisher Fine Art Ltd, London

Girl Doing Homework Plate V 1974
Henry Moore
A desk which provided storage at the work place served well when storage requirements were modest, when work was sedentary and activity confined to reading and writing. As the locker increased in size, leg room diminished and working heights became excessive. Moreover this type of furniture ceased to cater for the various activities and the mobility of school work.



Practical Tables, 1978
Susan Dickinson (10 years)
This painting, as does the etching by Henry Moore, conveys the character of the furniture. The table with uninterrupted leg room is easily moved and is responsive to the needs of various activities and group sizes.

In Part Two the experience gained from the projects is combined with more general experience over a longer period.

PIECEMEAL INSTALLATIONS OF SCHOOL FURNITURE

Examples do exist, though they are rare, of schools still enjoying the use of furniture installed over fifty years ago, where there has been little educational change, and the furniture has been tough. But most schools, understandably, acquire over the years a heterogeneous collection of furniture in a series of ad hoc adjustments to cope with change and deterioration. What is less justifiable is the initial installation of a miscellanea—sometimes because a manufacturer offers only tables and chairs, so that additional items are purchased from other unrelated sources; sometimes because furniture suitable for only a narrow age range is offered; sometimes because an authority, while gradually adding to its range over the years, introduces changing styles, colours and dimensions. There are too many "one-offs" and prototypes and insufficient cumulative experience. The criticism of ad hoc furniture provision, however, does not imply that uniformity should be the aim—this would only be valid if education were static, which it is not.

In schools visited, the most general cause for furniture to fail in response to educational change was the narrow age range for which it was designed, and its narrow educational "performance". For example, the division between provision for pre-schools and compulsory schools was more marked than could be justified on educational grounds. If an individual's progress is to be continuous in its gradual development, some furniture will be equally appropriate in both types of schools, for chronological age is not necessarily the equivalent of intellectual age. In many countries various ways are being found of incorporating pre-school units with primary, or basic schools. Furthermore, a pre-school child in one country could find education a legal obligation in another. And since not all children go to pre-schools the first stages of compulsory education need to provide for them.

In this connection the often conflicting responsibility for these contiguous stages of education is becoming increasingly anomalous. The projects provided evidence of pre-schools which were adjacent to compulsory schools, yet whose space standards and furniture were entirely different in cost, style and educational performance. There were also pre-schools for which suitable furniture was not available, and this led to the strange combination of formal classroom desks with the improvisations by teachers who were determined to overcome the shortcomings of supply and administration.

It is even more difficult to defend the division of furniture into separate categories within the stages of compulsory education. The absence of central guidance which could offer an overall framework has led to independent and unrelated design in response to ad hoc requests. The result was often an accumulation of furniture that did not mix, and there was no commensurate increase in choice for an individual customer. In one of the projects it was possible to design the furniture for pupils over 10 years of age as an extension of, rather than independently from, the furniture for pupils of under 10 years. The result was not only economical, but gave more choice overall by making possible the intermixing of compatible items. (Indeed in many instances the only necessary variation for the whole age range amounts to a few millimetres in leg length.)

The plea is therefore for comprehensive ranges of school furniture designed to meet the needs of the whole age range.

THE SETTING FOR SCHOOL FURNITURE: GENERAL CHARACTER OF THE INTERIOR

It is not easy to describe the richness of character evident in many schools which are prospering educationally. Perhaps the best analogy is a good craftsman's workshop, in which there is richness, variety and order that stem from the tools, the materials, the work in progress and the finished products—all of them about the place and arranged in such a way that work can proceed with enjoyment and efficiency. In a good school interior, as in a good workshop, there may be a lot of things about, but there will not be a slovenly confusion, because underlying all the variety is an order that is the direct result of the work in hand and the materials wanted for use, reference and inspiration. (This is quite different from a confusion of stuff lying about because there is nowhere else to put things that have already served their purpose, or that one day might do so.)

The contribution of designers of schools and of school furniture which allows and encourages good teachers to develop and enrich the places in which they work is, however, a subtle one. Little encouragement is given, for instance, by an offering of neutral space and some clinical furniture and fittings. Nor by an arrogant imposition of the latest cliché, or strong pervasive colour from which there is no escape—either of which is likely to become an irritating anachronism. Nor by an offering of a posh expensive (yet impoverished) set-piece "showroom" interior with its wall-to-wall carpet, engineered lighting and slick devices—though this may all fill the promoter's heart with pride and satisfaction when he sees so much glitter for his money.

So often, in attempts to cope with change, school interiors are, in educational terms, the old in modern dress. The greater variety and quantity of materials and equipment which are being demanded by education, together with the simultaneous pursuit of different activities instead of class instruction from the chalkboard, do indeed put both old and new schools—and their furniture—under stress. Skilful teachers improvise, and from this there is much to learn, but often a depressing and inhibiting muddle accumulates: more furniture and fittings are added over the years to the seating and desks that occupy the centre of the room—benches, bookcases, sinks, radios and so on—until there is a log-jam and the consequent plea for less furniture, but of greater variety.

CHARACTERISTICS OF A COMPREHENSIVE RANGE OF SCHOOL FURNITURE

What, then, are the characteristics of a school furniture range which is capable of meeting the developments in education? These can, in principle, be summarised very briefly, but they each need to be discussed in relation to a co-ordinated framework for the whole:

a) it is suggested that the main objective should be to achieve *variety and versatility*;

b) this implies the need for varying degrees of *mobility*;

c) this also implies *compatibility*:
   - compatibility between one piece of furniture and another, to enable different combinations and arrangements
   - compatibility between furniture and building to enable convenient deployment in relation both to the planning and the vertical surfaces of the structure;

d) there are three *particular attributes* of school furniture to be considered: materials specification, colour and dimensions.

Variety and versatility

Furniture for very young children is likely to be used in unpredictable ways—upside down perhaps—and to simulate all manner of real life situations during the course of purposeful play. It takes little imagination to convert a table into a hospital bed or a fire engine or bus. A point can almost be reached where the more exact the design for one particular purpose, the less generally useful will an item of furniture prove to be for the very young.

Increasingly, both for the younger and the middle age ranges, furniture is tending to become less specialised and more versatile. Perhaps one of the most dominant influences of educational development referred to in Part One is to weaken the marked distinction between furniture designed and used exclusively for academic work in classrooms (i.e. chairs and tables or desks), and furniture used in separate "subject rooms"—laboratories for example, or workshops—a distinction which continues to be reflected in many school furniture catalogues, and which discourages departure from

the status quo. This distinction is therefore giving way to a closer association between book work and practical work, between experiment and reference, whether in local centres or in supplementary shared work areas. Consequently, work areas in general are requiring a mixture of furniture, both of sitting and standing heights, both for clean and for messy work. Each article of furniture may be used for many different purposes. Most tables, for example, should have surfaces that are suitable for book work as well as for light craft work, and also be rigid enough for both purposes.

It is advisable to establish a range of height increments, from the lowest sitting height to the highest standing height. Within this, a table suitable for a tall pupil to sit at may be just as suitable for a short pupil to work at standing. (And yet it is still common for standing height tables to be considered entirely independently from those of sitting height.) Thus is should not be assumed that items are only relevant to the age range for which they were originally specified; nor should it be assumed that a more comprehensive approach to school furniture design, as work becomes less "scholastic" will not result in products that have a market in building types other than schools.

As tables became more general-purpose, manufacturers, by establishing a limited range of standardised components, finishes and attachments, can by various assemblies offer a variety of different finished products. Trolleys for storage and many other purposes, light craft tables, lightly serviced worktops are some of the items in the more varied schedules of furniture which are appearing in response to changing educational requirements.

Mobility

Furniture which sets out to be a "tool" in the users' hands must be easy to move about, giving teachers freedom to use it how and where they want, changing it around hourly perhaps, daily, or only once or twice a year. Varying degrees of mobility are needed. First, by easy push or pull, i.e. a trolley. Second, an easy lift by one or two persons, i.e. chairs, tables, screens, rostra and so on. And third, a more determined and less casual lift, i.e. cupboards and perimeter worktops.

Trolleys are often introduced with scepticism, for when viewed empty in the committee or showroom, their potential danger appears to be exaggerated. There are three points to make in their defence. Trolleys move less easily when loaded, and their design should be such that when loaded their centre of gravity is lowered. Some trolleys can be designed as "wheelbarrows", combining legs with castors, so that before moving, one end has to be lifted—e.g. sand/water trolleys, chalkboards. On some trolleys it is advisable to provide lockable castors—on science displays and workbenches for example. The number of trolleys which teachers improvise themselves or have made up—for music, science, cooking for instance—is strong evidence of their need, and an incentive to industry, provided the result is not an over-elaborate and over-expensive version of the original.

Mobility implies the absence of fixtures. There was a time, and may be there still is in some countries, when furniture was divided between what was fixed and what was loose, the former being part of the building contract and the latter of the furniture contract. This administrative procedure assumed and encouraged the fixture of some furniture, with a corresponding reduction in mobility. The procedure further divided the responsibility for the design and installation of articles which would eventually be seen and used together and made compatibility of style and dimension harder to achieve. Without general guidance or standards it is common for a fixed work table to be of a slightly different height from associated trolleys and tables. Frequently the built-in items have a more "architectural" quality, while the loose items may result from the routine selection procedures of supplies departments.

Inevitably, items of furniture on vertical surfaces—on walls or partitions, whether relocatable or of masonry—are not mobile, but designers are finding ways of giving teachers more freedom of choice (which is the purpose of mobility) in how displays on vertical surfaces, which form the background to their work, can be arranged. These ways involve ranges of components that can be assembled in different ways for two- and three-dimensional display. This is a radical departure from the chalkboard, whatever its colour and however engineered, and the notice board, however extensive, which may be supplemented by a cupboard or a bookcase. The freedom to compose with items on a vertical surface is compromised, however, if these have to be plugged individually to a wall. Therefore ways of hooking units to, or suspending them from vertical members may point the way forward. Of first importance is the need to consider items for pinning to, for writing or drawing on, for display (of books or other things) as a part of a related system in order to gain maximum compatibility instead of considering each individually.

Horsechurch Primary School (5–11 years), Essex
This interior suffers from the lack of a coherent furniture range. Cupboards, tables, shelves and chalkboards etc. have been added which clutter the space. Less furniture and more variety is required, with each item related to each other and to the space in which it is to be used.

Cobblers Lane Infants School (5–7 years), Yorks W.R.
A school interior furnished with a coordinated range of furniture in which sitting and standing height work surfaces, storage and display both mobile and fixed offer wide scope for different arrangements.

Longford Primary School (5–11 years), Ozon
Locker desks have been grouped and covered for blockprinting. One of the many activities which has caused their replacement by more generous tables.

Duff Hill Middle School (9–13 years), Bradford
A loose practical table in use for a science experiment. Note the service outlet in the dado rail at the appropriate height. The table is the same height as the worktop at the window and thus together can form a peninsular work area. A storage trolley can be seen under the worktop. These are some of the attributes of a flexible and coordinated furniture range.

Compatibility

Equally important, if furniture is to be moved about for convenient use in a variety of combinations and associations, is the relationship between one piece of furniture and another; the grouping of tables, the juxtaposition of trolley to worktop for instance. To achieve this relationship the designer must take into account three particular attributes [also mentioned under heading d)] materials specification, colour and dimensions which together form a trilogy on which compatibility depends.

A satisfactory relationship between one piece of furniture and another is not enough, however. Compatibility between furniture and building is also important, and this is more difficult to achieve. For generally there is no collaboration or contact between those responsible for the design of the building and those who design the furniture, and neither of them are likely to be very close to the day-to-day problems of teachers and children.

The "fit" between furniture and building depends on their sharing the same dimensional data and discipline, both vertically and horizontally. Thus the dimensional framework that governs the furniture must be known and understood by the architect before he starts work.[1]

Vertical dimensions should be ergonomically and anthropometrically generated. Seating heights must be known, for instance, before sill heights are determined, so that these can be satisfactorily related. Some furniture heights will determine the position of protective dados and service outlets. For example, the almost ubiquitous use of equipment dependent on electricity requires the frequent placing of socket outlets conveniently above worktops, whether these are in the form of benching or loose tables brought up to the perimeter. Another example: the eye levels of very young children suggest a zone within a meter from the floor in which they can examine things clearly, draw, and reach things. The various reaches of pupils of different statures will determine at what level it is sensible to mount displays, shelves, lockers, pegs etc. Data on this is included in Appendix II of this report.

Ergonomic and anthropometric influences are less strong on horizontal dimensions, which can often be determined more directly by sizes of sheet materials. Moreover the horizontal dimensions of furniture, such as table top sizes, are also influenced more by tradition stemming from economic circumstances than by more rational considerations. The sharing of the same module by the furniture and the building is not necessarily the universal remedy that it was once thought to be in the early enthusiastic days of modular co-ordination, particularly with the present decline in emphasis on built-in furniture. More important, the architect should know, as mentioned above, the dimensional framework that governs the furniture. He can then ensure, for example, that the distances between flanking walls, or between flanks and door or window openings, will accommodate multiples of the lenghts and widths of the various furniture items that may be arranged there.

There are other obstacles to be surmounted, however, before a really satisfactory relationship between furniture and building can be achieved. For instance there are a number of building features which often prevent the convenient deployment of furniture along perimeters of interior spaces, many of which are very evident in some systems of industrialised building. These include columns which stand clear of walls or partitions; pilasters; the difference in thickness between external walls and panels under windows. And there are the windows themselves.

Windows are too important from an educational viewpoint to ignore this aspect of their purpose. It is not surprising that in schools where pupils are for some of the time relatively free to choose their place of work, observations have shown that central positions are eschewed for those that offer a sense of location and a view out of a comfortably designed window. There are many precedents, both old and new, in other building types, and which schools might follow, where windows have been designed with lighting and anthropometric refinement as a focus from which to enjoy the outside and at which to work. Sill heights should be planned in convenient relation to common seating and standing working heights, proposals for which are given in Appendix II. Indeed, horizontal surfaces for sitting on, working at, and for display all offer opportunities, and to provide these on a mean scale, or not at all, can only be deplored. Windows have too often been regarded mainly as a contribution to an elevational composition, one example of this being to take them down to floor level in a crowded classroom where, in spite of the architectural merit they may have for some, they can be a danger, and inhibit the efficient use of space. (This is not to deny the value of this treatment in some other parts of the school.) There are, too, schools in which windows have become excessively small.

Perhaps the most common and irritating inhibition

to the deployment and use of furniture is caused by heating installations. The perimeter of a room, being a common location for heating surfaces and an important work position, demands special attention in detailed design. Failure to allow furniture to be placed along a perimeter wall is a waste of space—which is perhaps the most precious commodity in a school. Reading bays in one of the projects were compromised, for example, and the furniture layout invalidated by the unexpected installation of very hot heaters. There is no general design solution that can be prescribed except to plead for the collaboration between architect and service engineer. Somebody must be in charge, and that person should be the one with the interest of those who use the building uppermost in his mind.

Other service elements can also irritate. Has a display ever benefitted from an intrusive socket outlet, switch, thermostat, fire-point or clock? Again, someone must be in charge at an early stage, in order to avoid design being determined by a man with a screwdriver on the job. One can only advise that internal elevations be prepared which show outlets and service runs, so that their position in relation to doors, windows and furniture positions can be negotiated before work starts on the site.

Delf Hill Middle School (9–13 years), Bradford
The value of loose tables abutting a perimeter worktop is clearly shown here.

Evelina Lowe Nursery and Primary School (3½–11 years), ILEA
Generous horizontal perimeter work surfaces are most valuable, and the perimeter of the building interior should be designed to receive sitting and standing work surfaces, and seating, conveniently.

Montaigne Primary School (5–11 years), Jersey
A conscious piece of design which inhibits the use of the perimeter and is unsafe. The height of the dado rail does not protect the glass from the furniture. A horizontal surface at a suitable height would have been more useful.

Particular attributes

Having discussed the more general characteristics of school furniture, the three particular attributes must now be mentioned. Their importance has emerged because the formality of the set piece interior has given way to what, by comparison, must seem to some a pattern of ever changing confusion, when furniture is being constantly moved about, put to different purposes and frequently overloaded with work in progress and display. A range of furniture cannot retain its identity in these circumstances as it once did by regularity and repetition, and as it sometimes attempts to do by ostentation. There is, however, merit in achieving an underlying order, harmony or logic that can persist unobtrusively no matter what juxtaposition of items in a diverse range may be contrived. A family relationship within a framework of variety—a theme of this report—can be achieved by every item in a range sharing, where appropriate, materials specification, colour and dimensions. They will permit flexibility without confusion, dull uniformity being avoided by the variety within the range and the activities of people which are pervasive. Designers and manufacturers will have their own interpretations of this subject, which is discussed below in only general terms.

Materials specification

Most school furniture is likely to include the use of the following materials: solid wood, wood veneer, chipboard, steel tube, steel sheet, alloys, moulded plastic components, laminated plastic sheet, linoleum and sheet materials for display surfaces. In a very comprehensive and diverse range an orderly appearance, however items are shuffled, is encouraged if the same material is specified for the same element in each item. For example the same veneer on carcases of all kinds, the same material for all frames and so on.

Colour

The aim is here, as for materials specification, to maintain an identifiable logic within a framework of variety, and to avoid exaggeration, which would put the furniture rather than the pupils and their work in the foreground. But no decision related to furniture design has a more striking and lasting effect on its appearance than those taken about colour, and none is more difficult to make. One conflict lies between freedom of personal expression and disciplines imposed by large scale production. Another lies between the appearance of a range in the "show-room" and in use—an acceptable appearance after a few years of use is a greater achievement, and of more importance, than an attractive first impression. There is varying scope for choice. (Yet all colours have to be pre-determined through negotiation with different industries, and co-ordinated—a subject beyond the scope of this report.)[2] The general character of a colour range should probably avoid a chilling neutrality on the one hand, and stridency on the other, with a bias towards warmth and cheerfulness. The colour of some materials is of course pre-determined e.g. that of wood veneer. For some elements, such as metal frames, it is sensible to have a very small colour range. Such elements are repeated hundreds of times, many simultaneously in a single field of view; their linear form would be eye-catching and therefore irritating and distracting if strong colours were used, or the extremes of black and white. For these a warm, neutral bias, avoiding extreme of lightness or darkness, is probably more acceptable, and shows the effects of wear less. A wider and more colourful range is justifiable in sheet materials—table tops, for instance (but within suitable limits as a background for work).[3] Such colours can also identify table heights and relate these to corresponding chair heights.[4] Stronger colours on some plastic and painted products certainly have a place, and a small range of these can give sparkle and character by contrast with the others which are necessarily subdued for functional reasons. Such colours are usually most effective on readily identifiable elements such as panels, trays, chair forms—rather than on frequently "interrupted" linear elements such as lippings and legs.

The application of research work on colour has been fully described in two development projects carried out in the UK.[2,4&5]

Dimensions

Many aspects which control the dimensions of school furniture have been mentioned above. Here it is only necessary to place this attribute together with materials specification and colour to establish the trilogy on which depends the satisfactory relationships between a wide variety of units within a coherent whole.

There are three categories of dimensional influence on school furniture: firstly, anthropometric and ergonomic (chair and working heights, and reach to shelves and pegs for example); secondly the sizes of items in common use, such as coats,

bags, books, paper etc; and thirdly economic factors such as the sizes of sheet materials and of the spaces that can be afforded within the building. The final dimensions are an amalgam of all three, and the respective weight of each has to be judged by the designer according to the circumstances. (Examples are given in Appendix III.)

The plea here is that the designer, having judged the respective influences on dimension, should adjust or, so to speak, "tune" them to achieve the maximum number of workable juxtapositions and relationships between one item and another.

The increasing concern for the modernisation and refurnishing of old schools is highlighting the limitations imposed by the re-use of old furniture which is not dimensionally co-ordinated—particularly for storage units, many of which are too serviceable to abandon. Conformity to standard specifications which set out a dimensional framework would remove this limitation, so that carcases made over the span of years, even though stylistically dissimilar, could at least be used together tidily in refurnished premises.

1. An example of this can be seen in Figure 23. In this design, the dimensions of the building and the furniture were co-ordinated (a planning module of 900mm being a common dimension of wall-fixed furniture). Lengths of flanks could therefore conveniently accommodate wall-fixed units (e.g. adjacent to windows and doors in the four "home bases" shown on plan) and worktops in the bays. Sill and dado heights were also related to the various furniture heights.

2. For information on colour co-ordination in industry generally, see:

   a) H.L. Gloag and Mary J. Gold, *Colour Co-ordination Handbook*, Building Research Establishment Report, HMSO, London, 1978.
   b) "The Colour Co-ordination of Building Colours" BRE (Building Research Establishment) *Digest 149*, HMSO, London, 1978.
   c) *BRE News*, August 1978, HMSO, London.

   For information on colour co-ordination in schools particularly, see:

   d) *A & B Paper No 3*, "Delf Hill Middle School", Architects and Building Branch, Department of Education and Science, London, 1978.
   e) *Design Studies No 2*, "Ysgol y Dderi: An Area School in Dyfed", (see its Appendix V), Welsh Office, Education Department, 1976.

3. For recommended limits, see:
   BS 3030: 1972, Clause 5, British Standards Institution, London.

4. For a system of identifying table tops with chair seats and backs, see:

   a) "School Furniture 74", Pel Ltd., 1974.
   b) *Design Studies No 2*, *op cit* Note 2 e) above.

Part Three

PROCEDURES FOR DESIGN AND SUPPLY

THE OBJECTIVES

Parts One and Two have been concerned with educational developments and with principles of planning and design of furniture. In Part Three an attempt is made to point the way towards two main objectives:

i) to evolve a process which ensures the flow to schools of furniture of the quality, and at the cost and rate, appropriate to national circumstances;

ii) to evolve an ordered process of development and change in response to experience and initiative.

The participants will include central authorities, local authorities, institutes of research and standards, designers (salaried officials, independent, or employees of industry), manufacturers (craftsmen, or engineers in industry), users (educationalists, clients, teachers and children).

The ways and means of achieving the objectives will include:

Investigation and research, producing new knowledge and higher standards;

Application, i.e. the design and execution of actual building and furniture projects;

Guidance, through descriptive publications, discussions and courses, national codes of practice, standard specifications and guidelines, regulations (where appropriate);

A continuous cycle of association between user, designer and manufacturer, throughout the processes of investigation, design, production, use, assessment, and on to the next project.

Figure 20 shows diagrammatically the relationship between participants and activities in the design cycle.

The following paragraphs look briefly at the participants mainly responsible for schools and their furniture and suggest how some existing anomalies and frustrations might be overcome. For however skilful those concerned with planning and furniture may be, their intentions and hopes may be compromised by administrative procedures which only seem to frustrate. Moreover there are some who are held back by sheer lack of guidance. Examples of both conditions were encountered in the projects.

CENTRAL RESPONSIBILITY

The responsibility of a central authority may range from total to none. The pros and cons of total responsibility are well known. If the theory and practice works, schools receive their furniture with the minimum of fuss because teachers and designers have come to accept a system over which they have no control. Nationally defined policies and priorities can be fulfilled without compromise. There are cost and supply advantages when a single authority places large orders for a narrow range of products, and remote schools in modest circumstances can be serviced with the same quality as their grander suburban counterparts. The question of guidance is different because the authority, being the only operator, only has to inform itself. How does it do that? Teachers may feel remote and without influence so that initiative and enterprise is dissipated. How can good ideas and experience from the field be respected? Does the lack of personal connection between supplier and supplied breed indifference?

Unless such questions are answered and a process of evolution is built into the system, designs may persist too long. There are examples where an education ministry is developing curricula for which advisers are working at new room plans and layouts but who have no association with the building ministry which continues with schemes the users wish to supersede. There are also examples where two central government departments, each with furniture supply responsibilities, issue different specifications and apply different

procedures for the same type of furniture. One department prepares detail drawings and specifications demanding exact interpretation, while the other calls for quotations based on performance specifications. Furthermore these procedures do not share the same anthropometric or educational briefs, and items of furniture for the same purpose may range from the too bad to the too good.

SHARED RESPONSIBILITY: CENTRAL AND LOCAL

There are examples where the central government exercises some control, but the local authority or municipality orders the furniture—a combination which would appear to encourage neither initiative nor economy. In these cases the local authorities are obliged to comply with the central authority's standard schedules of furniture which for secondary schools are prepared by specialist advisers for separate subject rooms, and exclude non-teaching areas. A financial grant to the local authority for each school follows evidence of compliance with the schedules. The money spent is not based on tenders from manufacturers, whose products and prices are based on the schedules and grants. There is little variation of design or price between one manufacturer and another, and little encouragement for initiative or change. It is a procedure in which plans become stereotyped and ways of extending the uses of non-teaching areas seldom exploited. Only those with time and determination will pursue the possibility, which does exist, of negotiating variations (for example, a revised science laboratory layout, or different and simpler types of storage units).

A more appropriate division of responsibility between central and local authority would seem to be where the local authority would be fully responsible for providing the education service and for exercising its own skills in achieving value for money. The central authority would in that case only exercise those controls which were necessary to safeguard priorities, resources and standards on the one hand; and on the other, would promote guidance and ideas which would stimulate, and leave the way open for freedom of local interpretation. It would seem that the advantages of shared central and local responsibility cannot be reaped unless some such partnership and distinction of role is established. Without this, the local authority becomes merely an agency of the centre—or so remote as to be impotent.

LOCAL RESPONSIBILITY

There are countries where the central government department administers no control on school planning and furniture, and offers no guidance. Local authorities in these circumstances, particularly where there are no bodies contributing to research or standards related to furniture, are left to their own resources. Such resources inevitably depend on the skills, enterprise and wealth locally available. Standards will therefore vary widely with a majority of remote communities remaining out of touch and impoverished by comparison with larger and busier ones. It is not surprising therefore that industry, from necessity, takes an initiative that could not be imagined in those countries where they are little more than suppliers to large government departments. The vacuum will be filled by industry's association with the strongest medical authority and the most enterprising local authorities. The standards achieved may well be high, but they cannot represent any well defined policy or represent wide experience. The educational aims which they do represent will be a matter of chance rather than design.

For the majority of communities which are small, the building of a school is a major and infrequent occurrence. The first essential will be to get the building up. Furniture will be an afterthought and the amount of money will be what is left over, not what has been budgeted. There will be no local experience of comparative specifications and costs, all of which the manufacturer will supply from his experience from working with larger and more influential customers. This service will involve manoeuvring the schedule to fit the money the authority can find ad hoc: it will involve drawing office staff and others whose costs must somehow be reflected in the price of the furniture. The initiative has passed from the user to the maker —from the buyer to the seller.

Other ways have been experienced in which small local authorities have adopted less passive and more empirical methods where the central supply system permits local effort which is enterprising but amateur. The projects gave the opportunity of experiencing this in pre-schools where ad hoc methods are appropriate—more so than highly regulated ones. The process stemmed from a combination of enterprise and necessity: enterprise from strong educational convictions and necessity from the absence of suitable furniture on the market and available professional experience

to design it. So there was much improvisation and a reluctance to have a school furnished completely on day one. This has the merit of permitting opportunities to be seized and of encouraging the application of an individual's ideas, thus evoking the personal interest of teachers in their surroundings and keeping the stultifying standard layout at bay. Local craftsmen and small industries would interpret the proverbial "back of the envelope" sketch; wicker chairs would be bought from local markets; and the contributions from students in local technical colleges encouraged. Parents would contribute their skills too, so that the character of the interiors had an amateurish charm which was entirely in character with the gaiety of work and play and unpredictability in the preschool. The surroundings and the activity fit as well together as does the standard schedule and the standard curriculum. However the charm lacks the reliability of the professional product—one does not last long enough and the other perhaps lasts too long. Yet another of the polarities to be resolved by the designer. It is necessary for local initiative of this kind to be better informed about the specification of materials, codes of practice and standards, and to be aware of ideas that guide and do not swamp the enterprise.

GUIDANCE THROUGH DEVELOPMENT

There are two ways whereby an organisation may become qualified to give guidance; firstly, by participating in investigation and research; and secondly, by the application of special experience through the execution of projects designed to clarify the way forward. Research and investigation create new knowledge and promote higher standards, and the execution of building and furnishing projects applies and tests the knowledge acquired, and exposes areas of ignorance to be expunged by further research. Thus a perpetual cycle is set in motion.

Unofficial bodies can make valuable contributions, but their activities do not absolve the central goverment agency from the obligation to guide development. Firstly, development is not achieved by ad hoc work but only by a process of continuity and evolution; and, secondly the unofficial contribution, however laudable, may not have the necessary effect on the administrative procedures by central government to enable it to be applied by those whom it is intended to benefit. A purpose of central government's indulgence in development is to ensure that, through first hand experience, guidance is not only demonstrated but that administrative procedures are adjusted where necessary to make it possible for others to use it.

Development by central authority

Where a central government department is supplying a standard range of furniture on a national scale, the charge that the dead hand of uniformity is being wielded and that a vested interest in the status quo is being encouraged can be rebutted if at the same time development work, even on a small scale, is being pursued. This work would proceed independently from the main production flow, into which its results would be fed, as experience from new designs and procedures were tested in "one off" (development) projects. It is not, therefore, a matter of switching from standard range "A" to standard range "B", but allowing a single range to evolve in a controlled and manageable way. Over the years, if need be, a radical change could be made, during which some stages would be more disruptive than others. However, when the process was running smoothly change would consist only of minor adjustments, or "tuning" so to speak, in response to evolving economic, technical and educational circumstances. This underlines the necessity of continuity in development and distinguishes it from the different contribution of ad hoc activity.

The value of development by central government is not diminished when the supply of furniture is a local responsibility. As has been suggested it secures the adjustment of administrative procedures by reality, it achieves guidance from the most authoritative source, and it commands respect by combining mandatory requirement with practical leadership.

However, when central government has no responsibility for furniture supply, it must find a way of being associated with industry—development, as has been said earlier, relies on maintaining the cycle of user, designer and maker collaboration. One such method[1] that has been successfully employed is by long term contracts (ranging up to seven years) under which central government and industry incur the obligation to put on the market a new range of furniture to meet particular educational objectives. It was felt that this could not be achieved in a way that combined design, production and marketing skills unless they worked together as a team over a long period—which normal contract procedures do not permit.

An obligation of this special relationship is that the results of the work are made publicly available through publications and through normal competitive procedures. No financial or marketing privileges are enjoyed—the only special circumstances being the prolongation and the concentration of design effort. In all other respects development work must apply the same procedures and fulfil the same conditions as the work of those to whom the results of development may be a guide.

Development by local authority

The special obligations and opportunities afforded by guidance through development by central authority have been outlined, but the acquisition of experience through this process need not be a central authority's prerogative. In the United Kingdom, consortia of local authorities[2] have been formed since 1957, for the design and supply of building components and systems of school building, and since 1962 specifically for the design and supply of school furniture.[3]

Where a large number of independent, small and perhaps remote authorities do not have the programme, the skills or the experience to achieve the standards they may wish, they can, by collective association (a consortium) command considerable strength. By the assembly of a large and continuous programme of work they can establish a special and long term association with industry, and hence the appropriate conditions for development, as distinct from ad hoc work. At the same time the constitutional independence of each authority remains unaffected.

There are various ways in which a consortium might be organised but in general the policy would be formulated and guided by a Board of Chief Officers from member authorities, and the development work would be undertaken by a small development group, centred perhaps on the most experienced member authority, and financed by contributions from all members in proportion to the value of the furniture purchased. In the interests of keeping this group small, supporting responsibilities, such as supply and finance, might be undertaken by officers within member authorities. Whether the furniture layouts for each project were to be planned and scheduled by the development group or by member authorities themselves would be the subject of mutual agreement, and depend on circumstances. Such a development group, at the centre of an association of local authorities, and in working partnership both with industry and with client, would always have design and promotion as their prime responsibility.

The position of industry

Such a partnership as the one outlined above relieves industry of attempting to ascertain educational requirements from a distance, and also of taking the safe course of including in their catalogues only those designs which have been selling well in the recent past—which encourages the repetition of old experience rather than the introduction of new experience.

How to resolve change with efficient production in the furniture industry? Through the development group, whether central or local, industry is offered the opportunity of a continuous partnership with the client who has the order book in his hand. Because of this its bread and butter production of today (the current catalogue) can be continuously enriched by prototypes and development projects designed to meet emerging educational requirements—tomorrow's bread and butter. The gap between manufacturer and education is thus narrowed.

Manufacturers' catalogues will in the course of time reflect a more direct educational influence. Whether the catlogue of an individual manufacturer contains a wider range of furniture, or whether the wider range now required by education is dispersed in several more specialised catalogues, matters little—provided that the general characteristics and particular attributes that constitute the framework of variety and versatility as put forward in this report, are in some degree evident.

There are two main purposes for a catalogue to fulfil (which are sometimes confused so that neither purpose is well served). Firstly, the presentation of an attractive and readily appreciated impression of the character and appearance of the furniture, and the kind of educational purpose it is intended to serve.[4] Secondly, a methodical reference to every item, with sketch, code number, basic specification, basic dimensions and price.[5] This is wanted both by the designer and the purchaser for scheduling and ordering. For this, a modest and methodical presentation, which can be revised at low cost, is preferable to ostentatious bulk. Both the general picture and the detailed information may be combined[6] provided that each is distinct, and the information sheets can be detached and replaced as necessary.

A decision always to be made is whether the furniture is to be categorised by generic type or by the type of space for which it is appropriate.[7] The former method is preferable in that it presents no

presumption on planning and layout, while the latter has its convenience for those following familiar precedent.

GUIDANCE THROUGH RESEARCH AND NATIONAL STANDARDS

In 1978 there were fifty eight national standard bodies which were members of ISO (International Standard Organisation), but as yet there is only one international standard (in final draft form) for school furniture ("Chairs and tables for educational institutions—functional sizes"). Twenty nations have published a total of 132 standards on various aspects of school furniture but some are for very specialised items, and 47 of the 132 are for pre-school items. The subjects for standardisation are mostly determined by ad hoc considerations, with more emphasis on standardising particular designs than on the provision of standard data for design—which can safeguard quality and performance while allowing scope for technical and other innovations.

The projects have given evidence of the lack: the absence of data on national school populations; the mis-fitting of furniture; disparate national practices; and furniture that is either too strong or too weak. Table 1 indicates the confusion within one country when, without guidance, leading manufacturers go their own way and compatibility between furniture ranges is compromised.

Table 1

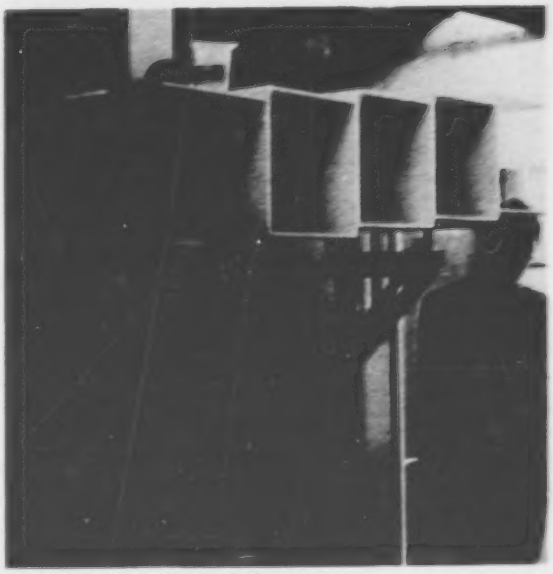
CHAIR AND TABLE SIZES AND THEIR IDENTIFICATION

Comparison between the catalogues of three leading manufacturers in one country.

Manufacturer 1			Manufacturer 2			Manufacturer 3		
Chair/Table Height mm	Size No	Colour Identity	Chair/Table Height mm	Size No	Colour Identity	Chair/Table Height mm	Size No	Colour Identity
320/520	2	Red	320/520	2	Grey	330/530	3	Red
360/570	3	Green	360/570	3	Red	370/580	4	Green
390/610	4	White	390/610	4	Blue	400/630	5	White
430/660	5	Black	430/660	5	Yellow	430/680	6	Grey

That central government should commission research and the publication of standards is a national obligation. Though subjects for research are without limit, the fact that a central body commissions the work should ensure that appropriate policies and priorities are established and that there is association with educational, economic and practical realities. Such research and standards are a concomitant of development work in the field of school furniture. Two main subjects are likely to dominate: anthropometrics and performance test methods. This is not the place to do more than emphasise their importance, except for a brief reference to performance tests.

The principle of ensuring adequate strength and durability by performance tests, rather than by design specification, is not a new one, but is not widely applied to schools. The diversity of strength requirements between different types of schools and in different parts of schools is now recognised in the UK by the current change from one basic performance test for each type of furniture to a choice of five grades representing different degrees of severity, from which an appropriate



Furniture Industry Research Association
Research for Building Bulletin No 38
An example of research commissioned by central government to establish basic data for design and subsequently published for general use.

grade is selected. Data of this kind is of equal value to the authority with large continuous programmes and to the individual purchaser.

DESIGN IN PARTNERSHIP

One valuable result of establishing a comprehensive procedure for the design, manufacture and distribution of school furniture as outlined above, will be the setting up of a small corpus of development group designers—a new breed of designer, attracted to a salaried post where the opportunities are primarily of social concern. These designers will be able, in relatively short cycles of investigation, application and experience, to have the satisfaction both of seeing results on the ground and of exerting an influence on policy.

Practical application is the safeguard against the remoteness of independent experts. Design that is imposed does not always succeed; but design that is based on learning through observation, recording, questioning in the schools themselves has a greater chance of success, and can open up new ideas and initiatives. Learning from experience "on the ground" will keep designers and teachers in touch. (However, "the ground" may not always indicate the way forward, but the principle remains: that the designer must be aware of the "growing points", whether these are to be seen in the schools, or read in the mind of those who affect policy.) Learning involves more than looking; it is possible to look—and to photograph—without actually seeing. It is also necessary to draw and to record. This report includes many examples of the recording of teachers' ways of working, of the organisation of space, of improvisations. In this way arrangements of furniture can be analysed, compared and communicated, and teachers can become aware that through their cooperation their experience can be taken into a mainstream of design development—thus they contribute at least to the surroundings of future teachers, if not immediately to their own.

Some examples of teachers' own arrangements of furniture (noted both in adapted and purpose-built schools) can be seen in Figures 2–7 and Figures 14 and 19—all in Part One. Analysis of activity patterns during the course of a morning in one of the project schools is shown in Figure 46 in Appendix IV.

Figure 21 illustrates how the initiative of teachers can give a measure of a—possibly new—need.[9] A "museum-resource" centre was established in a spare room.

Two examples of whole school plans, showing suggested arrangements of furniture are given in Figures 22 and 23: these were prepared for discussion with groups of teachers and clients at the sketch plan stage. Committees and clients should be encouraged to lean back in dismay if asked to comment on plans in which no furniture has been drawn (to an intelligible scale, and preferably coloured). Furniture not only indicates that the designer has considered to some degree what may go on inside the building, but brings the scheme to life.

The value of furniture layouts has encouraged the publication of furnishing kits. One of these[9] provides "labels" that represent furniture to 1/50 scale which can temporarily be adhered to a gridded baseboard and adjusted as necessary. The arrangement can then be photo-copied and the labels peeled off for re-use. More costly kits[10], which are very convincing, consist of sets of high fidelity furniture models to 1/20 scale, with which interiors of all kinds can be represented within a simply-drawn outline of part of a building. This is not an exhibition technique, but a re-usable working tool with which designers, clients and teachers can together study the organisation of space, and establish a schedule of furniture in a realistic way—both for the furnishing of new buildings and the re-furnishing of old ones.

Spring Gardens Middle School (8–12 years), High Wycombe, Bucks
An example of a study made by teachers, advisers and designers with the use of 1/20 scale models for the conversion of 4 independent classrooms in an old school to a Centre for 90 pupils and 3.5 teachers.

When a schedule of furniture consisted of little more than a chair and table place for each pupil, the layout could be "rubber-stamped" and there was little need for discussion. But modern furniture schedules are complicated and non-repetitive. For a particular set of circumstances, how many book trolleys? how many bench seats? should the tables be large or small, round or square? The phase "less repetition, more variety" is easy to say, but hard to define. Decisions can emerge from discussion and analysis of different groupings and work situations, which can be defined realistically and accurately by models. Moreover, the use of models can expose awkwardness of planning. For example: doors that fold directly onto a wall and prohibit the use of space at that point, whether by furniture or people; or excessive lengths of sliding-folding partitions which are a deterrent to the mounting of displays or the placing of furniture. Clearly this communication by means of models, drawings and discussion is likely to encourage design to become a partnership rather than an imposition, and will increase as development work on school furniture becomes more widespread. It is also appropriate for other educational buildings. One example is the College of Education where teachers are trained, as the caption for Figure 24 explains.

NOTES

1. For a description of the initiation of this method in 1966, see:
   a) *Architects' Journal*, 26 October 1966, pp 1035–1040.
   b) *Architects' Journal*, 9 August 1967, pp 345–350.

   For an outline of the contract with industry to which this method led, see:
   c) David Medd, "School Furniture Design: Some Experience in the UK", published in *Arredo Scuola 1975*, by ANIC, Milano, 1975.

2. *Building Bulletin 54*, "The Consortia", HMSO, London, 1976, para 6.

3. The following summary has been supplied by the Counties Furniture Group–C.F.G. (the School Furniture Consortium formed in 1962):

   Membership
   This is open to local authorities as either a full or an associate member. Full members who pay a joining fee are party to the Group's contracts and generally purchase the greater part of educational furniture requirements from the C.F.G. ranges. Committee members and the Group's officers are drawn from the full members.

   Associate members enter into no financial commitment but pay a proportionally higher cost for the furniture. Apart from attending the Annual General Meeting, they are not directly involved in the Group's business. They are, however, equal with full members in receiving catalogues and all other information and questionnaires on design development.

   The furniture is also available outside the membership, but at a higher price than either category of membership.

   In 1978 there were 25 local education authority full members and 15 associate local education authority members of the Counties Furniture Group. The total number of local education authorities is:

England:	104
Wales:	8
Scotland:	12

   Committees
   A Governing Body consisting of an elected council member and an officer from each full member meets once or twice a year and deals with budget, policy and contractual matters.

   An Executive Committee and Technical Sub-Committee comprised of officers of full members meets quarterly, the latter may co-opt specialists or appoint a specialists panel for a particular project.

   Officers
   Apart from Chairmen of the above Committees, the Group has a secretary, a treasurer, a supplies officer, a design co-ordinator and a legal adviser.

   Staff
   All the technical and administative work of the Group is carried out by staff employed by the member councils and is charged against C.F.G. on an annual basis. The major aspects are: design, which accounts for about 8 000 man hours and supplies, about 2 000 man hours per year.

   The design work, the majority of which is carried out within one authority, involves new design work, updating and improvement of existing ranges, user and market research, testing, preparation and circulation of catalogues, publicity and other information.

   Supplies work involves dealing with new contracts, periodic price reviews and negotiations, and progressing deliveries.

   Costs
   The Group's running costs are met from royalties on sales and by annual levy on full members.

   Contracts
   These are placed on a long term basis and are of a development nature whereby the manufacturers are expected to participate in the design development and in the marketing of the Group's ranges. In 1978 the value of the Consortium's business was about £5 million.

   Ordering
   Once item design details and production costs are agreed with the manufacturer each Group member places orders and progresses deliveries direct with the manufacturers.

4. One example of such a presentation is: "School Furniture 74", Pel Ltd., 1974.

5. Two examples of methodical references are:
   a) "Galvanitas", b.v. Oosterhout, Holland.
   b) "Eromes", b.v. Nijmegen, Holland.

6. One example is that published by Interiør Spesialisten, Rakkestad, Norway.

7. An example of a catalogue organised by type of space is that referred to above [Note 6]. Each type of room is illustrated by colour photographs, with which are grouped data sheets on all the items likely to be required in it. Items are therefore repeated where they are required in more than one space. The system is very easy to use when only standard rooms are required—but it does discourage any departure from them. This is an example of a catalogue in which furniture and equipment is illustrated which the company factors from other suppliers. It thus becomes a simple and comprehensive manual for specification purposes.

8. *Art in Junior Education*, HMSO, London, 1978.
In this publication an interesting variation is described and illustrated: a kind of "working museum" in which collections are displayed and in which art and crafts are also practised. The planned use of direct experience of artifacts can bring the impact of reality. The recording of such evidence by designers is a way of learning about what is actually happening in education, and can bring educational "growing points" to light. This is another example of how design work, both in planning and furniture, can be stimulated by improvisations in schools.

9. *Place and Space*, published by Globe Education, May 1976. The text accompanying this kit includes a description of the technique for use in the training of teachers.

10. Model kits made by Pel Ltd.

11. *Design Studies No 2*, "Ysgol y Dderi: An Area School in Dyfed", Welsh Office, Education Department, 1976, see its Appendix V.

Figure 20 INTERACTIONS IN THE DESIGN CYCLE

Life in schools is maintained by a cycle of activities which circulates through them and through central and local authorities. It is generated by policy and controls. Such a cycle can become stagnant unless it is constantly invigorated.

The ideas of those seeking change—whether inside or outside this mainstream cycle—will distrupt the life of schools if they do not have the means or the authorities to implement them.

By injecting research and investigation—which is tested through development "on the ground", and is promoted through guidance, standards, regulations and policy—the mainstream cycle is continuously stimulated by those who have the authority to implement change.

Design is both within the "mainstream" and the "tributary"—the former providing experience and the latter keeping it fresh.

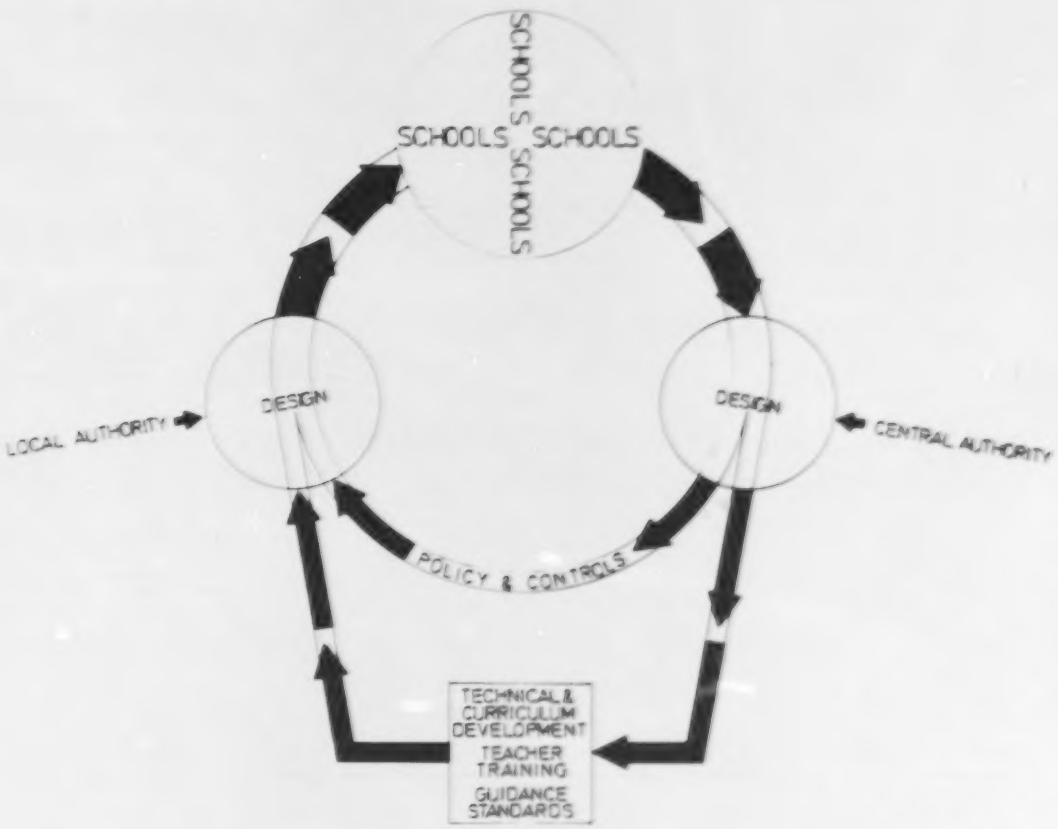
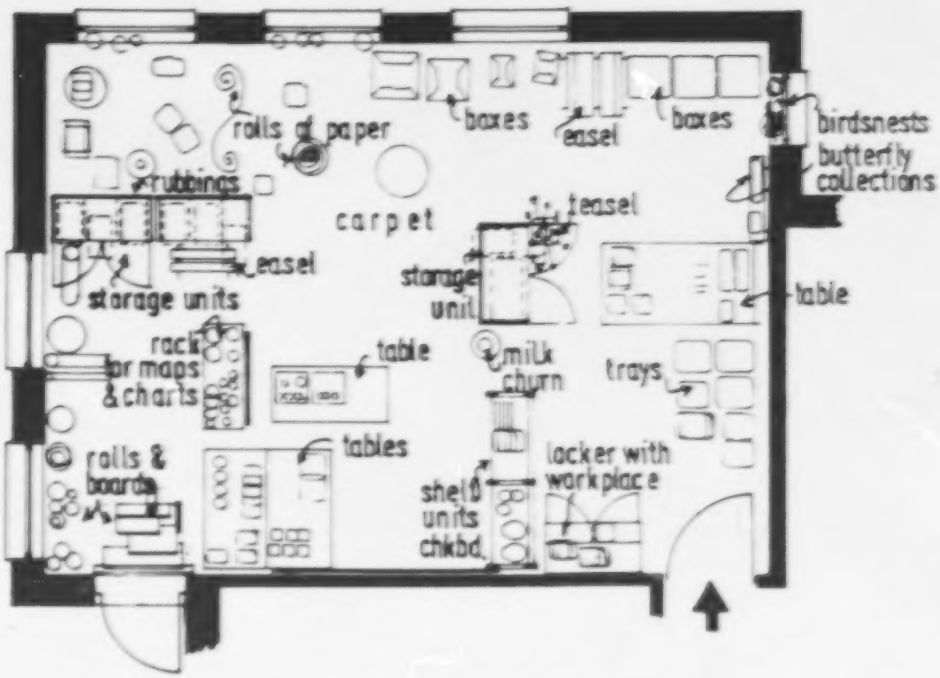


Figure 21 MUSEUM RESOURCE ROOM (Middle Age Range) Guillemont Junior School, Farnborough, Hants

This museum resource room functions as a small home-made local authority museum service, containing a wide range of objects from local sources for use in projects of work. They are catalogued by the same system as the books in the school library, and form a valuable and expanding source of study. The use of this spare room gives the measure of a need not usually provided for in terms of planning and furniture.

SOME HEADINGS FOR THE COLLECTION

LOCAL GEOGRAPHY
GEOGRAPHY
POSTERS
NATURAL HISTORY
MAPS
'INDIVIDUAL ITEMS'



LAYOUT OF THE COLLECTION
(28·6·78)

Figure 22 SKETCH PLAN (Pre-School)
Domme, Dordogne

A sketch design for a small pre-school for 35 children adjacent to an existing primary school, and sharing a dining room with it. The furniture shown represents a selection from a range in production, and within the limitation of the plan, suggests the character and variety of activities afforded by the interior. In practice the furniture would often be re-arranged, but not to a degree that would change radically the purpose of the different zones.

81

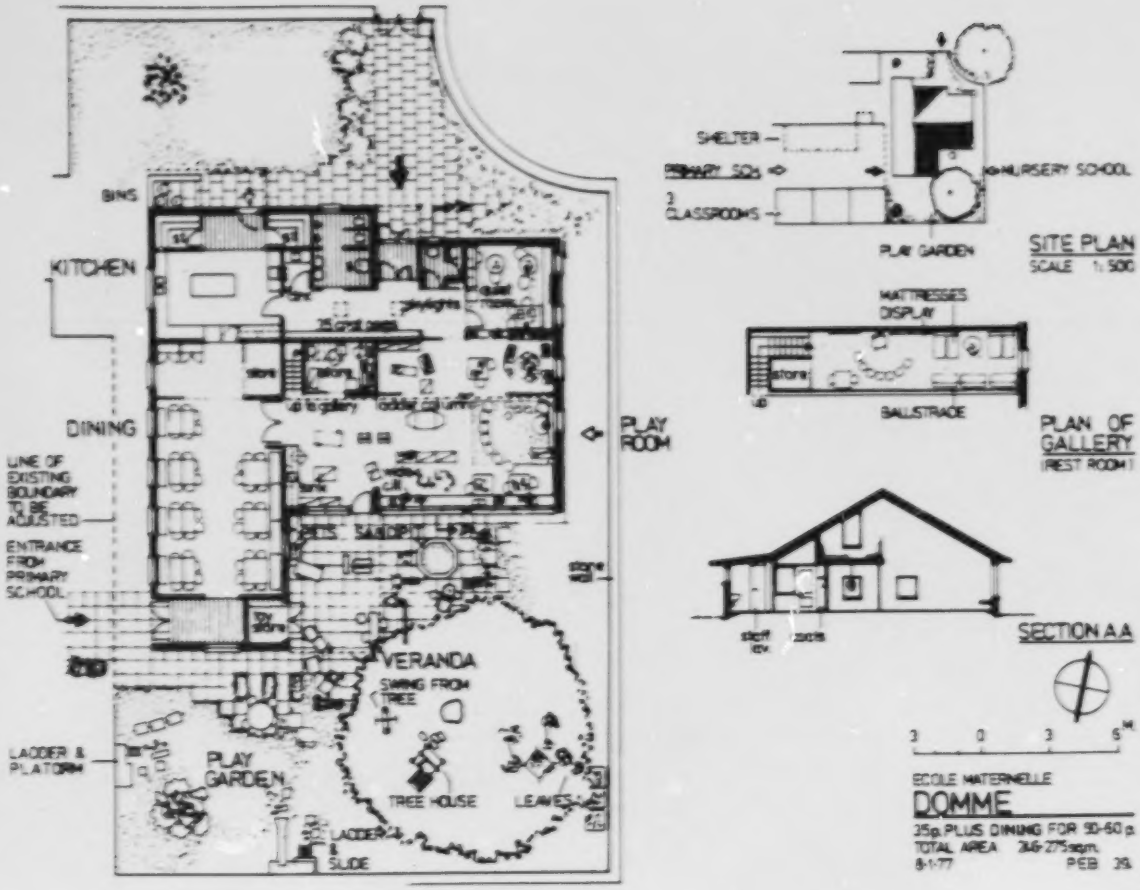
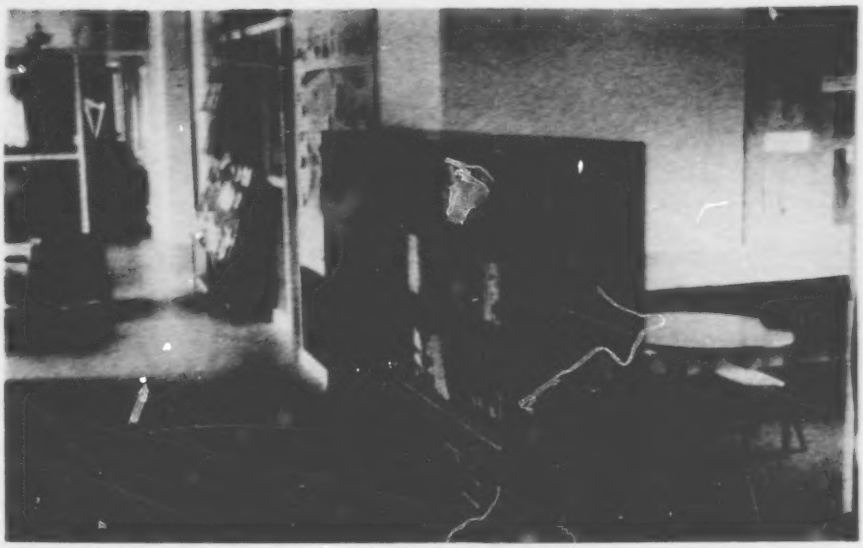

BINS
KITCHEN
DINING
LINE OF EXISTING BOUNDARY TO BE ADJUSTED
ENTRANCE FROM PRIMARY SCHOOL
PLAY ROOM
VERANDA
SWING FROM TREE
LADDER & PLATORM
PLAY GARDEN
TREE HOUSE
LEAVES
LADDER & SLIDE
SHELTER
PRIMARY SCHS
3 CLASSROOMS
NURSERY SCHOOL
PLAY GARDEN
SITE PLAN
SCALE 1:500
MATTRESSES DISPLAY
STORE
BALUSTRADE
PLAN OF GALLERY
(REST ROOM)
SECTION AA
3 0 3 6M
ECOLE MATERNELLE
DOMME
35p PLUS DINING FOR 50-60 p.
TOTAL AREA 349-275sqm.
8-1-77
PEB 35

Figure 23 PLAN (Younger Age Range) Llangybi Area School, Dyfed

The whole plan of this small school was set up, with 1/20 scale models of the furniture proposed, for presentation and discussion with teachers and representatives of the clients. The final furniture installation has been described in detail.[11] It conforms to the proposed ISO Standard (Draft International Standard ISO/DIS 5970, 1978). The dimensions of the building and the furniture were co-ordinated (see Note 1. at end of Part Two).



Ysgol y Dderi (3½–11 years), Llangybi, Dyfed
The storage divider units screen Home Base 1 from the project bay in the centre for 50 pupils from 5–8 years. They are part of an installation for which the building and furniture dimensions have been carefully coordinated.

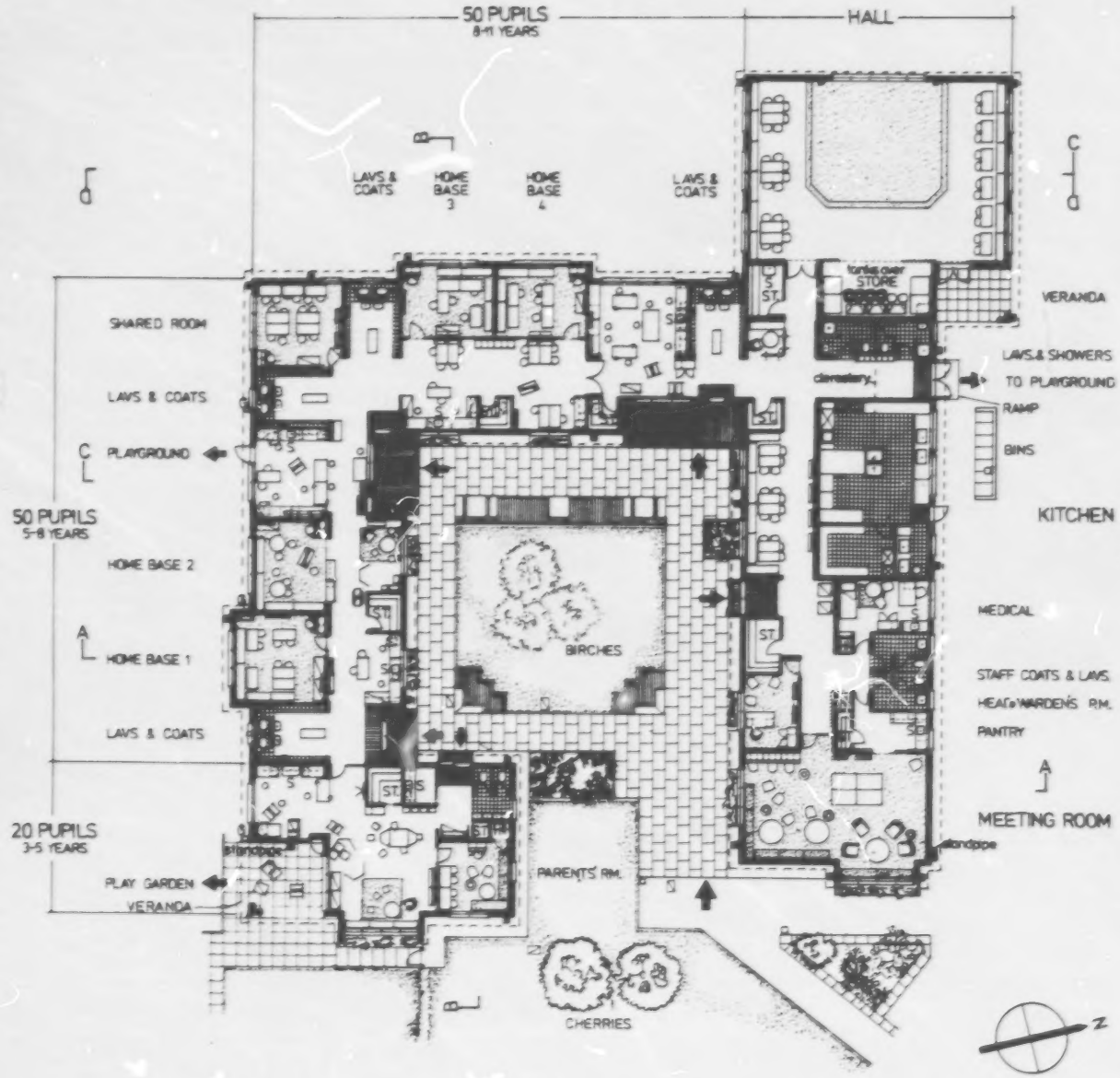
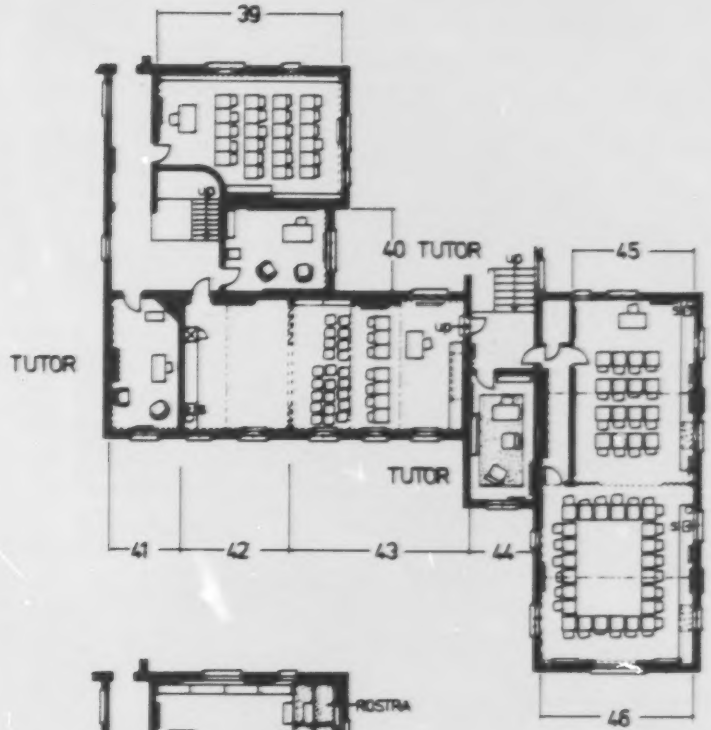

50 PUPILS
8-11 YEARS
HALL
LAVS & COATS
HOME BASE 3
HOME BASE 4
LAVS & COATS
SHARED ROOM
LAVS & COATS
PLAYGROUND
50 PUPILS
5-8 YEARS
HOME BASE 2
HOME BASE 1
LAVS & COATS
20 PUPILS
3-5 YEARS
PLAY GARDEN
VERANDA
BIRCHES
PARENTS' RM.
CHERRIES
VERANDA
LAVS & SHOWERS
TO PLAYGROUND
RAMP
BINS
KITCHEN
MEDICAL
STAFF COATS & LAVS.
HEAD & WARDEN'S R.M.
PANTRY
MEETING ROOM
N
ANALYSIS OF AREA
TEACHING AREA
TOTAL AREA
5-11 YEARS
COMMUNITY
3-5 YEARS
S 0 5 M 10

Figure 24 ADAPTATION FOR POSTGRADUATE COURSE (Teacher Training) Bishop Grosseteste College, Lincoln

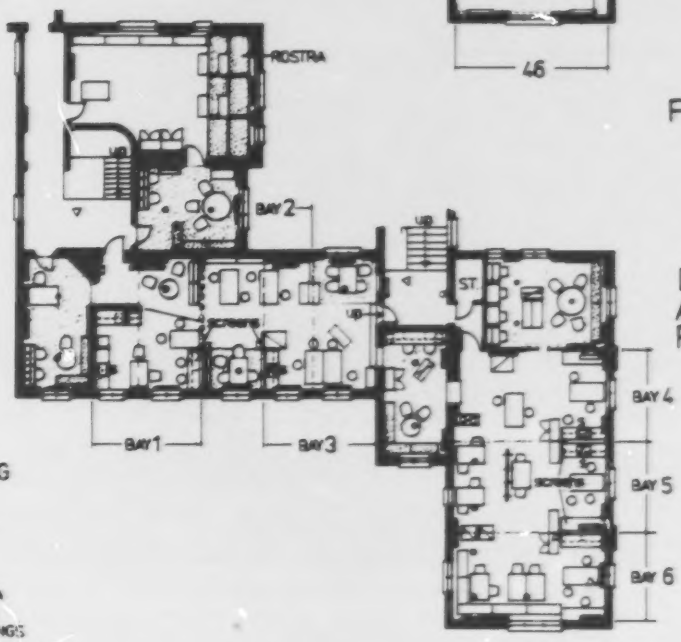
The adaptation of 250 sq.m of space in an old building—a College of Education—for about 100 postgraduate primary school students. The aim was to create surroundings for training purposes which were not at variance with those of the schools in which the students were preparing to work.

It will be observed that this transformation, which has important educational consequences, is almost entirely achieved by furniture. The arrangement of this was worked out with 1/20 scale models.



LAYOUT BEFORE ADAPTATIONS & REFURNISHING

FIRST FLOOR

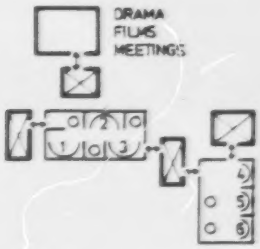


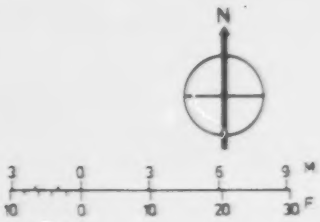
LAYOUT AFTER ADAPTATIONS & REFURNISHING

SEMINARS

REFERENCE, WRITING

PRACTICAL WORK

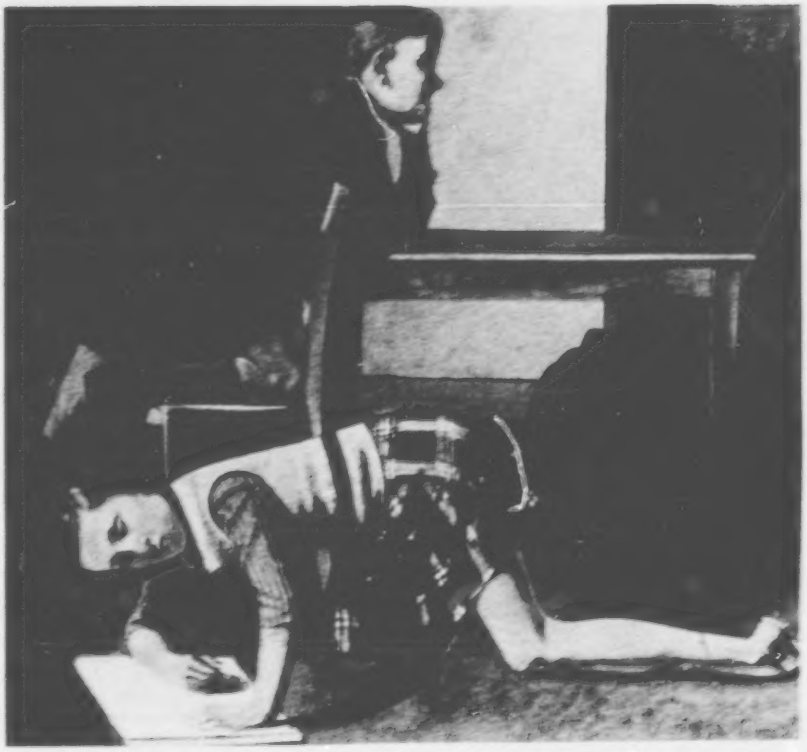




ANALYSIS OF ADAPTATIONS

Appendix I

CATEGORIES AND DIMENSIONAL DISCIPLINE FOR SCHOOL FURNITURE



«Les Enfants» – Balthus, 1937. (From the Catalogue of the Donation Picasso exhibition, 1978).
Tables and chairs are the basic constituent of a school furniture range, but how they will be used is unpredictable. Therefore their design and dimensions should not be tailored to a single activity or a single posture.

Seating, work surfaces, storage and display: these are three main categories into which the increasing diversity of items in a school furniture range can be distributed. Designers and manufacturers who succeed in marketing an educationally complete range are few, and this reinforces the need for a measure of compatibility between different ranges, in order that clients can conveniently assemble their requirements from different sources. This is one function of standard specifications, whether national or international. This greater diversity which is now required is a marketing problem in that items which are wanted in relatively small numbers may be educationally important.

Understandably, chairs and tables of various kinds form the majority of items offered in most school furniture catalogues, but education is now providing a stimulus to designers to exercise imagination—not only to widen the interpretation of seating and work surfaces, but also to widen the scope of items for display and storage. Some suggestions follow, but no attempt has been made to note the many detailed but important requirements and variations of each type. After suggesting a list of relevant items in each of the three categories, some dimensional considerations and relationships are noted.

SEATING

Chairs, upright

The familiar article in standard sizes for all ages. Standard specifications define basic requirements, but often there is insufficient emphasis on the need to suppress impact noise on hard floors.

Chairs, easy

Although various types are normal in rooms for adults, easy chairs can also have a place in libraries, book corners and "home bases" for very young children (but here an old upholstered or rocking chair may be chosen).

Stools

A range of stools to serve all the standing height work surfaces in a range. Foot-rests, stacking, backs and stability are features to be considered.

Bench seats

These are invaluable—either hard or upholstered, and without backs—as perimeter seating: in staff rooms, "home bases" or dining areas which may have a peak number of people for short periods of time; in informally furnished rooms for small groups; in libraries. If available in incremental lengths and heights (related to upright chairs) *they provide quick and economical seating in many circumstances and in all types of school.* (And can be used also as a work surface for very small children sitting on the floor.)

Seat cubes

Moulded or foam-covered cubes, popular with young children listening to a story, or looking at books for instance, can also be used as building blocks by them.

Play boxes

Seating is one of the many purposes for which these can be used.

WORK SURFACES

It is assumed that the types of work surfaces summarised below are available in the appropriate range of sitting and standing heights for all ages, and that they conform to the plan size recommendations given later in this Appendix (see under "Dimensional relationships"). Often, catalogues offer the normal classroom chairs and tables to the exclusion of sloping and horizontal surfaces at standing height, these being considered only in separate subject rooms for senior pupils. But in fact there is a lot of work done at standing height surfaces by pupils of all ages. (In Appendix II, Table 2—from Building Bulletin No 52—there is

evidence', for instance, that children from 3–5 years may work standing up for between half and two-thirds of the time and that pupils from 11–13 years for one-third of the time.)

Tables for clean work

Plan sizes may be needed for from one to eight people at a time, but larger groups can be catered for by butting tables together—an important influence on design. The increasing use of hard, slippery surfaces is to be deplored except where hygiene is the prime consideration. Hard surfaces cause clatter, and it is difficult to pick things up from them. It is also difficult to hold things firmly on slippery surfaces. It does not seem easy to rival the time-honoured materials such as wood and linoleum for the top of work surfaces, but experience should be recorded of the satisfactory use of chipboard for table tops in one country for up to twenty years.

Tables for messy work

These are of two types: those with tops which need to be kept clean regularly (such as for domestic subjects) for which hard smooth impervious surfaces are sensible; and those on which tops it is appropriate to allow the evidence of work to accumulate, rather than to preserve a pristine condition, such as for messy crafts. Wood is a traditional material for this purpose, but linoleum and hardboard are also serviceable and can easily be replaced. The design of lippings is important in respect of hygiene and safety.

Perimeter work surfaces

Tables are usually free-standing, but can be used at the perimeter, for which however surfaces of longer proportion are more appropriate. Similar qualities to those of table tops are required, but incremental lenghts are necessary for the assembly of long runs and for tailoring to building dimensions. Supports may be of separately assembled components, ready assembled frames, or supporting pedestals. In all circumstances free access from the front is required for workplaces, for the garaging of various trolleys and for general storage.

Attachments to work surfaces

The attachment of a hook, bag-rack, tray-slide, cupboard or carrell to a sitting height table (although restricting access to a degree) will, by providing some storage at the workplace, convert a plain table into a desk or a study carrell. The scope of plain standing height tables can similarly be widened without manufacturing special models, by the attachment of shelves, tray-slides, cupboards and vices.

Additional work surfaces

Work surfaces should not be considered as being confined to articles specifically identified as such. Indeed pupils are likely to find ways of using most items in a range as a work surface: for example tops of trolleys, screens, easels and so on. Much ingenuity can be exercised in making items serve several purposes, so that the distinction between work surface, display surface and storage surface may sometimes be hard to define.

STORAGE AND DISPLAY

It may be useful to consider storage in a hierarchy of provision, ranging from a "room store"—which is an architectural planning concern—through cupboards, shelves and trolleys to the smallest tray or compartment within a piece of furniture. Economy has often reduced the incidence of "room stores" without providing for a corresponding increase in storage in the form of furniture.

The value of a "room store" is frequently compromised by the presence of plumbing, cylinders and electrical gear, but also by the inadequacy of the shelving. Storage for large sheets of paper and card is a perpetual request, and this should be in compartments (not slatted) at least 100 mm deep and with plenty of room for the hands to select and pull out the sheets. Narrower adjustable shelves are advisable above worktop height. Empty wall space in a store is a lost opportunity for storage.

Storage in furniture is frequently for more immediate use, and a point is often reached when the division between storage and display is very small. Display is temporary and visible storage for reference and for stimulating the imagination and may constantly be changing. The most striking evidence from the projects was the "increased motivation" that was caused by provision for display. Reading and the use of books generally, for example, increased when books were released from the tightly packed shelves behind cupboard doors, and shown face outwards on the sloping surfaces of trolleys and display shelves. Not only books but all manner of displays stimulate and instruct: models, pictures, weaving, pots, artifacts collected from the past, from holidays and from the surroundings of a school. Teachers themselves are often the first to

provide for all this, and many a run-down or over-designed interior has been given a ship-shape and workmanlike character by their enterprise and ingenuity. But a real contribution to the quality of the school interior which designers could make would be in the design of simple and unobtrusive devices with which teachers could compose two- and three-dimensional displays. There is a noticeable gap to be filled between those who market teaching materials and those whose concern is furniture. (Cardboard boxes and filing cabinets have their place, but they secrete rather than display, and "out of sight is out of mind".) Something is needed which bridges the gap between the filing cabinet and the noticeboard.

Another factor affecting furniture for storage and display is the changing pattern of the work itself. Teachers, instead of issuing text books or standard kits to each member of a class, increasingly need to make available selected combinations of written material and objects at particular locations, for small groups. This implies mobility, and the ability to make frequent changes. The following items are suggested.

Floor cupboards

These can be placed either against a wall or in free-standing positions to divide a space into smaller areas or bays. Some, therefore, may face both ways, with central division and each side fitted with shelves. Others may be full depth, with trays and shelves, and their backs used as display surfaces—or in special circumstances fitted with sound-absorbing panels. Doors should be optional.

There are three heights normally in use, to serve different functions. Depth and lengths can be standardised for different heights and types, so that trays and shelves are interchangeable (see note on dimensional relationships below).

Trolleys (carcase)

These should accommodate various complements of the same range of trays and shelves as for cupboards. Similarly some might have display backs, and optional doors. Tops should be thought of as work and display surfaces, and they should be easy to manœuvre. Various dimensional attributes are discussed elsewhere. One for large sheets, maps and charts, stored on shallow trays will be of value—most schools are under-equipped in this respect. Mention has already been made of teachers' initiative in making their own trolleys for various purposes.

Trolleys (frame)

The scope is too wide for complete definition, but trolleys can be for the following purposes, for example:

projection equipment
dressing up clothes
coats and bags
sand and water
audio equipment
general service purposes.

Some dimensions will be determined by particular items (e.g. coats), but where possible, width should be systematised to accommodate standard trays and shelves as loose items, so that their capacity and purpose can be adjusted. Common dimensions also simplify their "garaging", and association in use.

Trolleys (book)

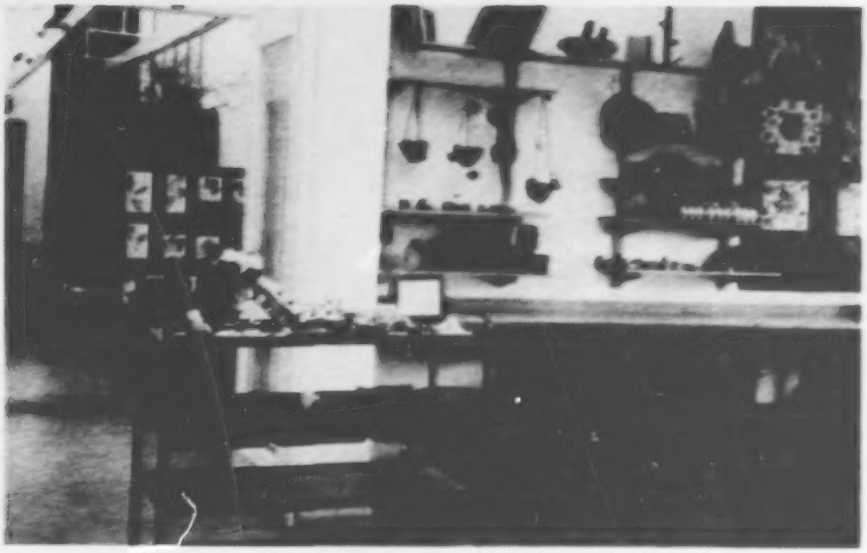
These are perhaps of the first priority, and several types are likely to be required. For younger children, box compartments and face display are needed. Trolleys with face display on both sides are widely used; also those with face display on one side and shelves on the other.

Nigel Paige

Leapman's Diary Times October 1978
A pupil's imagination can be sparked by good display in the school, as the shopper can be impelled to purchase in the supermarket.

Stapleford Infants School (5–7 years), Notts CC
Seating may include many types (rocking chair and seat cubes are illustrated here). Note the display and storage at eye level for young children.

Woodside County Middle School (8–12 years), Amersham, Bucks CC
Stools are shown here with standing worktops under which there is plenty of leg room, and space for the placing of various types of trolleys for storage.



Ysgol y Ddavi (3½–11 years), Llangybi, Dyfed
In a coordinated range of furniture worktops whether fixed or mobile, and various items for storage and display can easily be used together and in many different ways. The furniture becomes a tool in the teachers' and children's hands — not a set piece.

Townhill First School (5–8 years), Southampton
Here trolleys and tables have been temporarily arranged to make an area for mathematics. The trolleys have trays for pupils' belongings and for the categorised storage of equipment, and on the back there is pin up for charts etc.

Delf Hill Middle School (9–13 years), Bradford
In this shared area in the 2nd year centre a combination of sitting and standing height work surfaces and trolleys for display and storage can respond to the needs of different activities and group sizes.

Evelina Lowe Primary School (3½–11 years), ILEA
Display can be on the smallest and on the largest scale. In this example the building and the furniture combine to provide both. The rostra can be folded for compact storage and used also for drama and physical education purposes.

Screens

These may range from draped clothes horses in pre-schools to expensive sound-absorbing dividers of space. They can combine the functions of display surfaces and work surfaces, and there is much scope for ingenuity in their design. Some types of easel can also be used in similar ways.

Storage and display items attached to vertical surfaces

This has been discussed in principle in Part Two and it is only necessary to emphasise here the importance of simplicity and versatility. Surfaces are needed for pinning into, for writing on, and to which large posters, maps and charts can be attached. For three-dimensional objects shelves of different kinds will be moved from one position to another, and small cupboards, with trays and shelves, will also be needed (see Figure 30). Assemblies may be from floor to ceiling, at very low level—particularly in pre-schools—or in line over a length of worktop.

DIMENSIONAL RELATIONSHIPS

The importance of tray size (see Figure 25).

A small plastic tray can be used for a multitude of unpredictable purposes. Its dimensions will probably be related to stationery sizes, but in fact it becomes a kind of module which imposes a discipline on most carcase and frame dimensions within a range of furniture and the more circumstances in which it can be used, the more versatile will the range become—and the more it will justify the moulded techniques which are logical for its production. No item should be added to a range of furniture without first considering in what way it might incorporate a tray—whether the item be a working surface, a trolley, a floor or wall cupboard.

Table plan sizes

This is a subject of controversy. The most common function for determining plan sizes in the past has been the width occupied by a pupil using a text and an exercise book. In some countries this is still the basis, but as it can be so variously interpreted, it forms no common ground. One interpretation of this basis is shown in Figure 26. In modern education, however, the activities for which tables are used are so multifarious and unpredictable that a different basis has proved more satisfactory in many schools. This is one in which the geometric properties of table tops permit efficient grouping as shown in Figure 27. The dimension which normally generates this discipline ranges from 450 mm–600 mm, and in the interest of reducing unnecessary variation the ISO Standard has proposed that lengths and depths of tables should conform respectively to a module of 1000 mm and 500 mm. Efficient grouping implies that the construction of tables should permit pupils to sit with equal comfort on all four sides, which means that storage at the work place is unlikely to be practicable. Tables in libraries, workshops and studios, science laboratories and for other more specialised purposes should share a dimensional basis which permits convenient juxtaposition and the use of standard trays under them.

The question of table heights is governed by entirely different factors and is discussed in Appendix II.

Carcase dimensions

The overall dimensions of carcases which contain different combinations of trays and shelves should enable them to be assembled tidily in line, or back to back. As mentioned above, floor cupboards, for instance, can have standard depths and lengths, but many different arrangements of trays, shelves and cupboards within. Of the three heights, one is related to standing working plane (700–900 mm region); one to heights of pupils, for use as space dividers (1200–1500 mm region); and a third related to adult reach for storage purposes (1800 mm region).

Trolleys should share the same increments of height as standing height worktops, so that they can either extend a worktop, or be garaged underneath, as shown in Figure 28. (Spacing of worktop leg supports should not prevent such garaging.)

Relation between tables, screens and trolleys

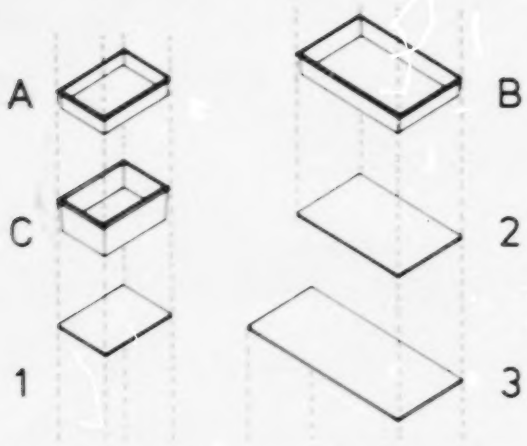
Another example of useful juxtaposition is shown in Figure 29, in which items usually used independently are brought together to make a work location, to define a particular area, or to compose a display.

Relation between items fixed to vertical surfaces

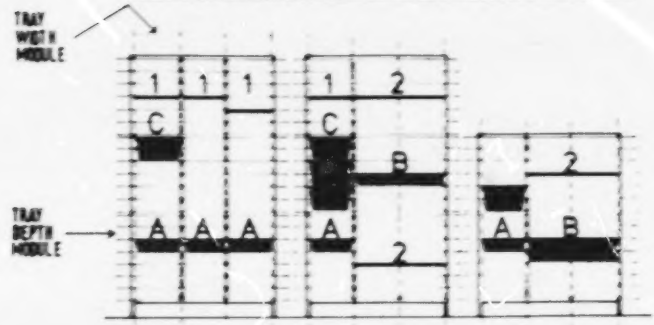
A dimensional relationship between the length of shelf uprights, the length of shelves, the length and height of wall cupboards, and the areas of chalkboard and display panels is shown in Figure 30. Order and versatility can thus be combined in the composition of displays on vertical surfaces.

Figure 25 TRAY SIZE
Influence on Carcases and Frames

The tray becomes a kind of module, imposing a discipline on most carcase and frame dimensions within a range of furniture. No item should be added to a range without first considering in what way it might incorporate a tray.

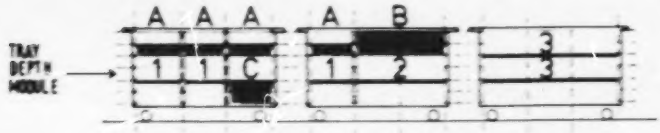


INTERCHANGEABLE TRAYS & SHELVES



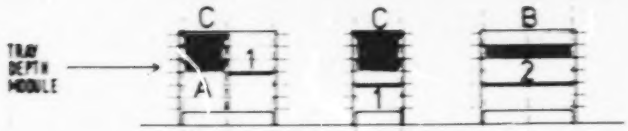
LENGTH GOVERNED BY WIDTH OF TRAY

STORAGE UNITS



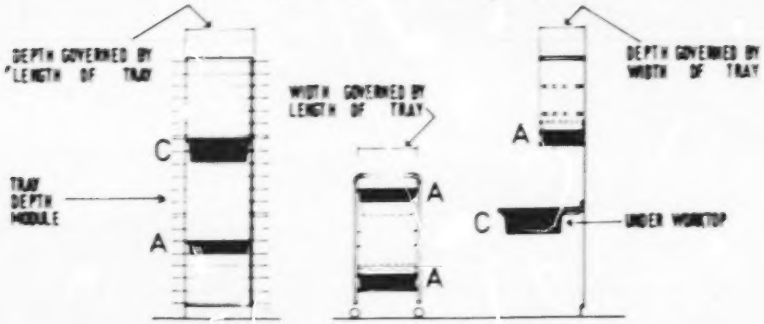
LENGTH GOVERNED BY WIDTH OF TRAY

STORAGE TROLLEYS



LENGTH GOVERNED BY WIDTH OF TRAY

PEDESTALS


DEPTH GOVERNED BY LENGTH OF TRAY
TRAY DEPTH MODULE
WIDTH GOVERNED BY LENGTH OF TRAY
DEPTH GOVERNED BY WIDTH OF TRAY
UNDER WORKTOP

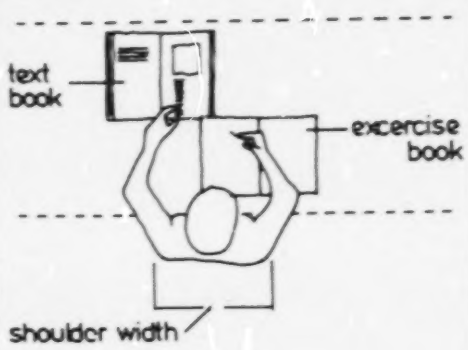
STORAGE UNITS | FRAMES | WALL CUPDS.

Figure 26 TABLE PLAN SIZES
Formal Work

In the past, the plan sizes of tables were usually determined by the width occupied by a pupil using a text and exercise book. In some countries this is still the basis, but it could be interpreted in many ways. This is one interpretation.

MINIMUM	DESIRABLE
55 110 / 50 / 100% 100% single double	55 110 / 50 / 100% 100% single double
stature range 1000-1120 mm. chair/table hts. 260/460 •	% satisfied SIZE 1
55 110 / 50 / 94% 82% single double	60 120 / 100% 100% single double
stature range 1120-1300 mm. chair/table hts. 300/520 •	% satisfied SIZE 2
60 120 / 50 / 95% 75% single double	65 130 / 100% 100% single double
stature range 1300-1480 mm. chair/table hts. 340/580 •	% satisfied SIZE 3
60 120 / 50 / 83% 73% single double	65 130 / 100% 100% single double
stature range 1480-1620 mm chair/table hts. 380/640	% satisfied SIZE 4
65 130 / 50 / 79% 67% single double	70 140 / 100% 100% single double
stature range 1620- mm. chair/table hts. 420/700	% satisfied SIZE 5

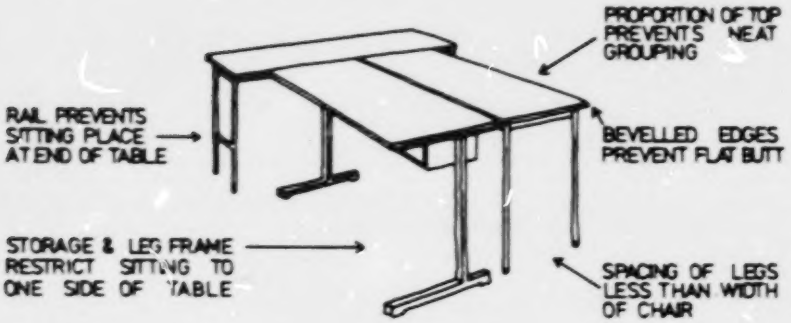
CONDITIONS IN FITTING TRIALS



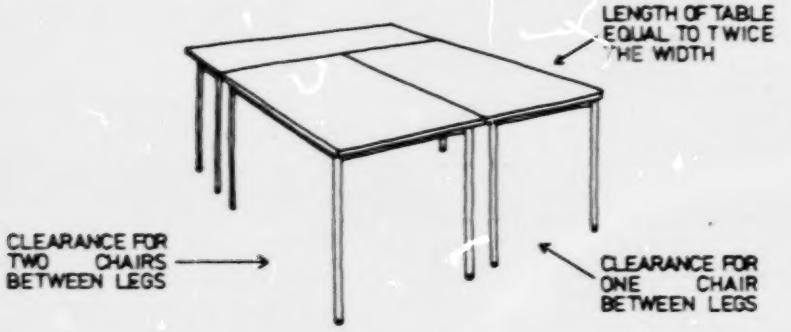
ISO SIZE	av. age of subjects yrs.	ms.	mean stature (mm)	mean shoulder (mm)
1	5	1	1105	240
2	7	6	1280	265
3	10	7	1385	315
4	13	9	1590	355
5	16	10	1730	380

Figure 27 GROUPING OF TABLES
General Work

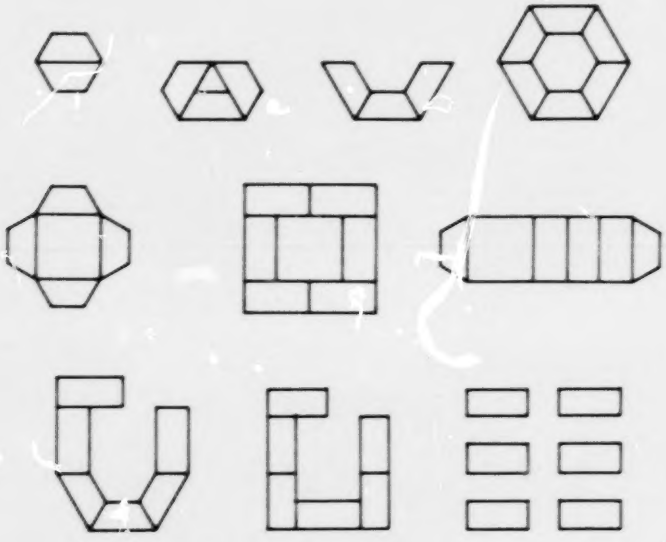
When tables are used for many—and unpredictable—kinds of work they are often grouped together in a variety of combinations. The dimension which normally generates the discipline inherent in efficient grouping ranges from 450–600 mm.

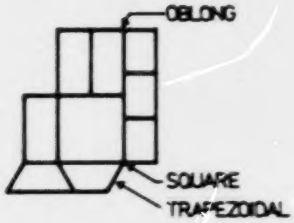

PROPORTION OF TOP PREVENTS NEAT GROUPING
RAIL PREVENTS SITTING PLACE AT END OF TABLE
BEVELLED EDGES PREVENT FLAT BUTT
STORAGE & LEG FRAME RESTRICT SITTING TO ONE SIDE OF TABLE
SPACING OF LEGS LESS THAN WIDTH OF CHAIR

SOME FEATURES WHICH LIMIT THE USE OF TABLES



SOME FEATURES WHICH PERMIT MAXIMUM USE OF TABLES





3 BASIC SHAPES DIMENSIONED TO GROUP FOR GENERAL WORK

SOME EXAMPLES OF TABLE GROUPS

Figure 28 RELATIONSHIP OF SITTING AND STANDING HEIGHTS 3–19 Years

This diagram shows standing heights extended on a regular increment from sitting heights. A furniture range should include both, and the possibility of tables and trolleys extending worktops, and of trolleys garaging under worktops.

AGE RANGE (yrs)	(SB SIZE NUMBERS) (HTS mm) 3 500	4 543	5 700	6 753	7 829	8 886	9 943
3½ - 5	○						
5 - 8		●	○				
7 - 9			○	●			
9 - 12				●	○		
11 - 13				●	○		
13 - 16					○	●	
16+						●	○
	select from alternative hts. (std. dsgn. use E645-650)						

STANDING WORKING HEIGHTS

Figure 29 TABLE, SCREEN, TROLLEY
Dimensional Relationship

Items usually used independently can be brought together to define a particular area or work location, or to compose a focus of display.

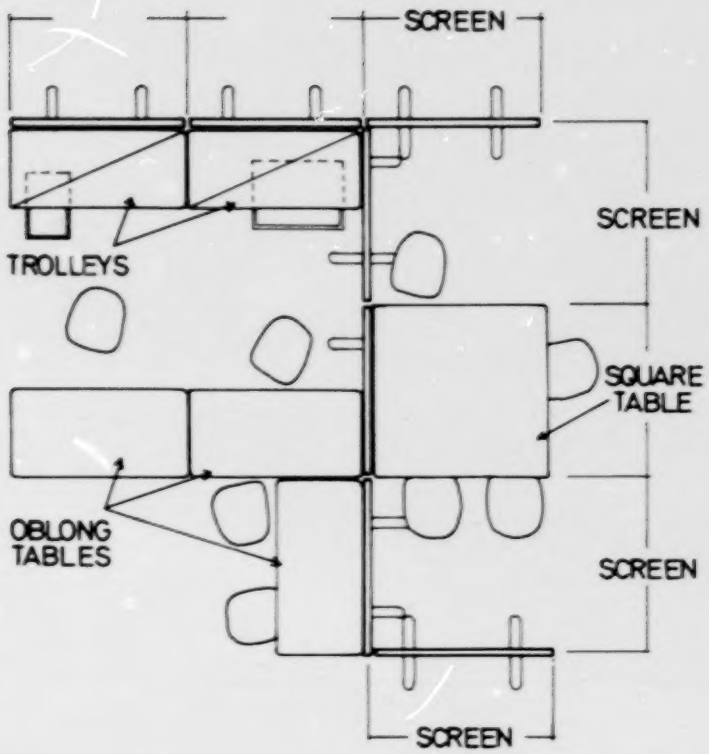
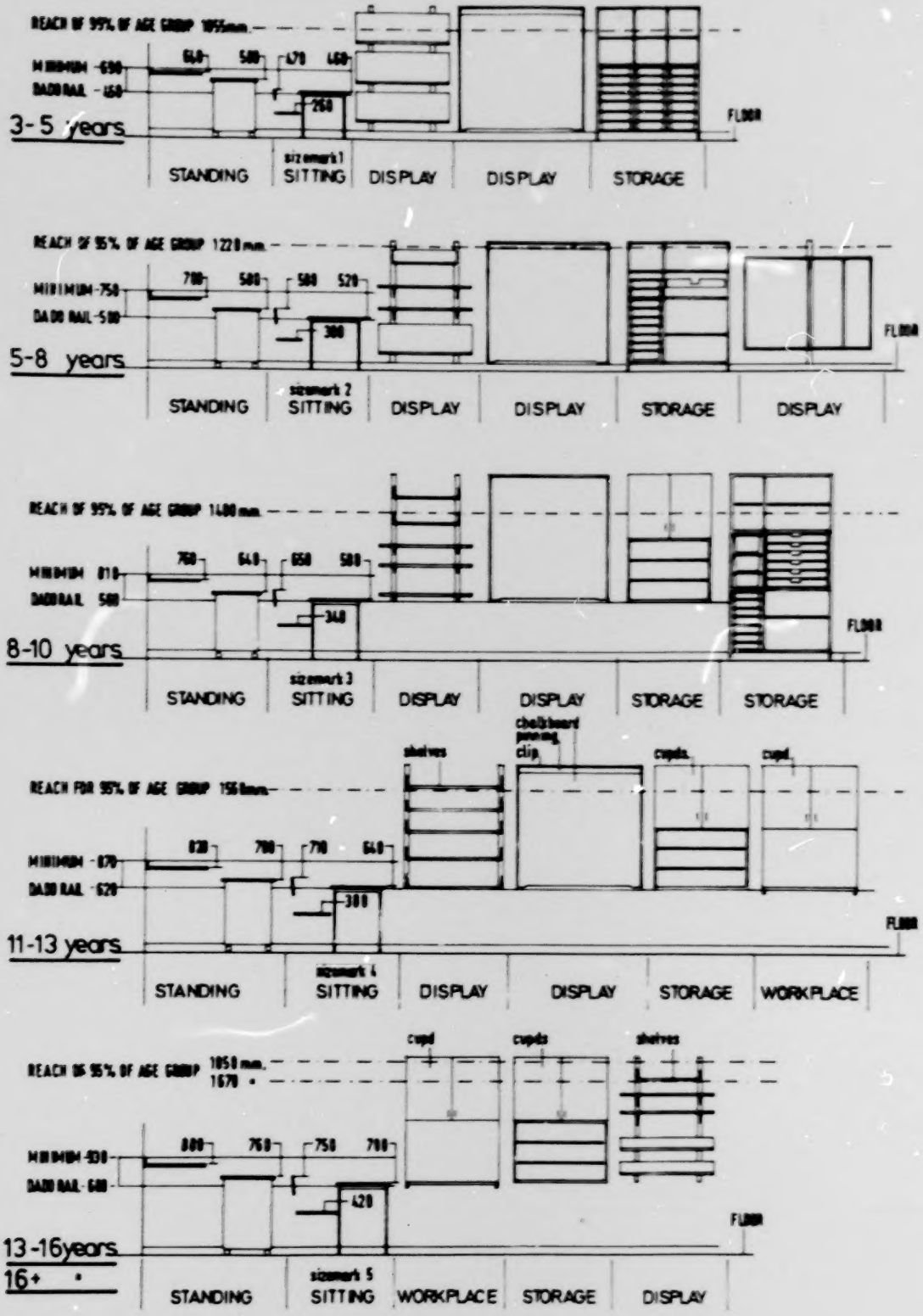


Figure 30 FLOOR AND WALL-MOUNTED FURNITURE
Dimensional Relationship
3–19 Years

This diagram shows the relation of floor and wall-mounted furniture for five groups of age ranges, and how they can be adapted for different statures. It also shows how their dimensions make different juxtapositions easy to achieve.


3-5 years
STANDING
SITTING
DISPLAY
DISPLAY
STORAGE
5-8 years
STANDING
SITTING
DISPLAY
DISPLAY
STORAGE
DISPLAY
8-10 years
STANDING
SITTING
DISPLAY
DISPLAY
STORAGE
STORAGE
shelves
cupds
cupd
STANDING
SITTING
DISPLAY
DISPLAY
STORAGE
WORKPLACE
cupd
cupds
shelves
13-16years
16+
STANDING
SITTING
WORKPLACE
STORAGE
DISPLAY

Appendix II

THE DISTRIBUTION OF CHAIR AND TABLE HEIGHTS

BACKGROUND

A hundred years ago, in the cut and dried days of classrooms, desks were precisely designed for pupils engaged in listening to the teacher and looking at the chalkboard and their books. Regularly the shorter pupils took the same positions at their lower desks in the front, and the taller pupils at their higher desks at the back. Discomfort and deformity through prolonged sitting periods could be alleviated by furniture that fitted well. This was not difficult to achieve in those simple circumstances. As the curriculum expanded and pupils brought more books to school, the narrow shelf which previously did not interfere with leg room[1] proved inadequate and consequently was replaced by a deeper and wider shelf; and finally by the commodious locker desk.

By the middle of this century surveys[1a] showed that it was common for school desks and tables to be too high by approximately the depth of the locker of shelf. This was the cause of bad posture. It is a tale of the decline of seated comfort in schools since the 1880s, when Cecil Reddie—a pioneer of progressive education in England who paid attention to every detail of building and furniture—imported chairs and tables from Stuttgart, specially designed to prevent malformation of the spine.

Fortunately, the criteria for good seated posture have long been established and have been published since 1958: in England in Building Bulletins[2a] and Standards; in other countries by research workers. Also since that date the sedentary nature of school life has become less dominant, ranges of furniture related to pupils' statures have again become available, and habits have changed in the carrying and storing of pupils' belongings. However, the existence of such ranges of furniture does not guarantee its easy distribution, nor does it ensure good fitting, for changes in school organisation and teaching methods are making it more difficult to find easy or simple solutions.

CHANGES AFFECTING DISTRIBUTION

Some examples of these changes are:

a) children of pre-school age are becoming more closely associated with schools;
b) stages within the compulsory years are being constantly adjusted;
c) pupils are staying longer in schools;
d) vertical age grouping, when it occurs, increases the stature range in teaching groups;
e) adults are increasingly using school accommodation;
f) schools are often being occupied by an age range of pupils for which they were not designed.

But it is changing teaching methods which affects the distribution of furniture most fundamentally. As described in Part One, the pattern of long sedentary periods of time spent in classrooms, with occasional excursions to special subject rooms, is giving way to more complex patterns, in which there are both small and large-scale movements from one work place to another, using work surfaces at sitting and at standing heights. And it is unlikely that any of these will be used regularly by the same pupil, or for only one kind of work.

There is some physical merit in this movement, for the tension that induces fidgeting during long sedentary periods is not experienced. Movement is no longer regarded as a misdemeanour: "now it is accepted that young children need frequent opportunities to move and change their position quite apart from the times which are specifically set aside for physical education".[3] Some of this

movement which is needed for the healthy growth of young children is now, in fact, automatically part of the routine of learning. The medical and design professions concerned with school furniture have to respond to circumstances in schools which will not remain static for their benefit.

None of this removes the obligation to provide good fitting furniture, but the ways in which this can be achieved must differ from the specification of graded sizes for static groups of pupils of predictable ages.

The figures in Tables 2 and 3 are selected from a brief study [4] of postures in schools, which indicates a measure of the complicated reality for which one is designing.

The mobility in some schools can be expressed in another way by the figures shown in Table 3, indicating the length and number of "sits".

Table 2
PERCENTAGE OF TIME SPENT AT DIFFERENT WORK POSITIONS
By age groups

Age range (years)	Work positions						
	Sitting working	Sitting listening	Chair only	Other furniture	Standing up	Standing working plane	Total time %
3– 5	2.9	2.4	9.1	22.8	33.5	29.3	100
5– 7	13.7	9.6	0.4	45.8	21.0	9.5	100
7– 9	19.6	5.8	5.6	25.0	27.7	16.3	100
9–11	25.7	11.2	9.3	15.1	21.9	16.8	100
11–13	33.6	20.9	3.7	8.9	18.2	14.7	100
13–16	34.1	40.0	2.3	2.3	12.2	9.1	100
16+	34.6	38.7	2.0	1.9	13.1	9.7	100

Table 3
NUMBER OF "SITS"

Age range (years)	Proportion of day spent sitting on chair. % Average for subjects	Length of "sit" Average (min.)	Average number of "sits" per pupil for whole day		
			short 1–9 min	medium 10–29 min	long 30–59 min
3– 5	17	3.8	9.6	1.2	0
5– 7	22	4.9	11.7	1.4	0.1
7– 9	31	4.3	18.4	1.9	0
9–11	38	5.8	16.3	2.8	0.4
11–13	58	11.1	11.7	3.3	2.1

The figures in these two tables apply to individuals rather than to class groups. They are quoted to do no more than indicate a trend and thereby encourage thought on how to design for the reality of today rather than to assume that things continue to be as they were.

From this, certain conclusions can be drawn:

a) that more variety of furniture is needed than has previously been provided;

b) that not all pupils will always be seated at the same time;

c) that if pupils are seated only for a proportion of the time—and the younger ones for a significantly smaller proportion—then a more accurate fitting is advisable for the older than for the younger pupils. This by no means indicates that the criteria for a good fit should not

be applied to younger children, but that the application can be less precise, the types of seating can vary more and not all the pupils need be provided with the same type to use simultaneously;

d) that there is a clear connection between educational trends, furniture design and the distribution of sizes.

THE NUMBER OF SIZES

In the past the procedure for satisfying the needs of different statures was to provide more than one size—and sometimes as many as four—in a single classroom. This served when each pupil sat at the same place continuously. But when movement in schools (both within one room and amongst different shared work areas) implies that many work places are common property, the distribution of graded sizes can be defeated in two ways: firstly, with several sizes in one room, chairs and tables can become mis-matched; secondly, as a pupil moves from one place to another he may be obliged to sit—or to sit by mistake—at a "wrong" size. Moreover, the habit of grouping tables to form a large flat surface is compromised if they are of different heights. In principle, the conclusion must be that an area furnished with three of four sizes of mis-matched furniture is likely to cause more serious mis-fitting than a well judged distribution of a carefully selected single size.

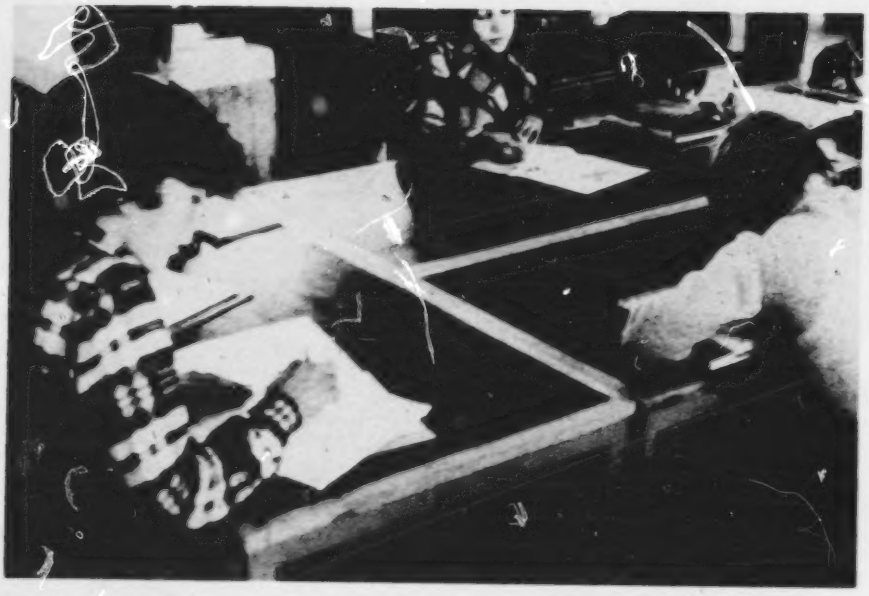
Therefore the case for "stretching" a single size to cater for a maximum stature range is a strong one. It was for this reason that fitting trials were made, to establish the maximum tolerances that could be accepted. The fitting criteria were adjusted to relate to the sitting habits of different age groups. The importance of securing the maximum clearance between seat height and underside of table becomes paramount, and is the reason for insisting on larger clearances than those proposed by the ISO Standard (which may still be influenced by more formal teaching methods). Figure 31 indicates the minimum leg clearances that are recommended at each of the ISO sitting heights.

How far a single size can be extended will partly depend on the plan and organisation of the school, but three or four sizes in one room are hard to defend, and the case for more than four sizes for the 3–13 year range (relevant to the projects), and for more than five sizes for the 3–19 year range is equally hard to make. Reference to Figures 32 and 32 A, in which statures and ages are related[5] indicates that for a two year age range, two sizes do not necessarily give a better fit than one size, in the working circumstances for which furniture is increasingly being designed. It is better to feel one's way in a new situation than to persist with old procedures in new circumstances (and there could be an element of academic snobbery in worrying about a few millimetres—of which the pupil cannot be aware).

Delf Hill Middle School (9–13 years), Bradford
The stature range in this school in 1971. Unfortunately children of the same height — or even the same age — do not work in one place. As many parts of the school are used by all pupils and statures of children of the same age vary widely, the hope of achieving accurate furniture fitting is usually defeated by school organisation and the physical facts.

Townhill First School (5–8 years), Southampton
The practice of teachers working with children increases the importance of tables and chairs being designed for the widest stature range (i.e. each size offering the greatest leg room) and for grouping and all round sitting.

Escola Preparatória (10–12+ years), Loures, Lisbon, Portugal
Inadequate leg room obliges awkward and uncomfortable postures.



Escola Preparatória, Maia, Portugal
The new range of furniture mentioned in the Introduction of this Report provides adequate leg room, more generous and versatile work surfaces.

THE NEED FOR DATA AND MORE RATIONAL PRACTICE: EVIDENCE FROM THE PROJECTS

The following paragraphs present evidence from the projects to highlight a number of problems. They also present some British and ISO data which may assist national practices. But first, a plea must be made for dimensional data that is relevant to design for the whole school age range (approx. 3–18 years). Assuming that the body proportions of pupils are similar in those countries for whom this report is relevant, much can be derived from national statures and reference to British data.[6]

It is common for recommendations on furniture sizes, whether from industry, local or central authorities, to relate only to the years of basic education. But these are being overtaken by the extension of education both upward and downward in the age range. It is hard to justify such variant practices as those exposed by the projects. For example, in Norway eight sizes are specified (by medical authorities commissioned by industry) for nine compulsory years of education (7–16 years); in Spain three sizes for eight years (6–14 years); and in the United Kindgom five sizes for eleven years (5–16+ years). This report pleads for variety, but only where it is suggested by educational practice.

It is hoped that with the publication of the ISO Standard, and with a serious study of national population data, industry will be encouraged to serve more, with fewer sizes, and make fruitful interchanges possible—at lower cost.

Norway

Table 4 gives eight recommended furniture sizes for the 7–16 year age range in Norway and the recommended distribution in schools. A stature range of only 9cm is specified for each size, and thus up to four sizes are required for a single year age range in one room. No stature data are available for children below seven years old, and the sizes that have been added for the youngest pupils are not a logical extension of the larger sizes, and therefore cannot be used conveniently with them. The stature increments would seem to be too regular to have been determined by fitting trials with children, and the multiplicity of sizes is necessitated by the very small differences between seat and table heights.

Table 4
RECOMMENDED DISTRIBUTION OF FURNITURE SIZES IN NORWAY

Size No	Stature Range (mm)	Seat Height (mm)	Table Height (mm)	Distribution in Classes of 30 (Oslo)								
				Barneskole						Ungdomskole		
				1	2	3	4	5	6	7	8	9
				7–8	8–9	9–10	10–11	11–12	12–13	13–14	14–15	15–16
		300[a]	500[a]									
		340[a]	540[a]									
2	1200–1290	320	520	18	10							
3	1300–1390	360	570	12	20	20	8	2				
4	1400–1490	390	610			10	18	18	8			
5	1500–1590	430	660				4	10	16	10	3	
6	1600–1690	460	700						6	15	17	10
7	1700–1790	490	750							5	8	15
8	1800–1890	520[b]	790[b]								2	5
9	1900–1990	550[b]	830[b]									

Notes: [a] These sizes are added by some manufacturers for children aged 3–6 years.
[b] These sizes would appear to be too large for use in schools particularly if adjustments were made to the lower sizes.

Table 5 compares Norwegian and ISO sizes recommended for the project.
Table 6 illustrates the adjustment to the Norwegian sizes that are necessary to convert them to ISO sizes. The local authority intended to do this.

Table 5
COMPARISON OF NORWEGIAN AND ISO SIZES
Applied to Levre School, Baerum, Norway.

Age Years	Stature (inc. 25 mm for shoes) 2.5%ile	97.5%ile	Recommended Norwegian Sizes (mm) Size No.	Seat/ Table Height	Seat/ Table Diff.	Estimated Stature Range Fitted	Recommended ISO Sizes (mm) Size No.	Seat/ Table Height	Seat/ Table Diff.	Stature Range Fitted
5–6	1045[a]	1285[a]					1 2	260/460 300/520	200 220	1000–1180 1120–1300
6–7	1095[a]	1385[a]					2	300/520	220	1120–1300
7–9	1175	1485	2 3	320/520 360/570	200 210	1180–1300 1330–1410	2 3	300/520 340/580	220 240	1120–1300 1300–1480
9–11	1245	1615	3	360/570	210	1330–1410	3	340/580	240	1300–1480
			4 5	390/610[b] 430/660	220 230	1450–1500 1620–1800	4	380/640	260	1480–1620
11–13	1345	1745	3	360/570	210	1330–1410	3	340/580	240	1300–1480
			4 5	390/610 430/660	220 230	1450–1500 1620–1800	4	380/640	260	1480–1620
			6	460/700	240		5	420/700	280	1620–

Notes: a) British 5–95 percentile figures. Norwegian data not available.
b) Seat too high, thus restricting stature range fitted.
c) Small difference limits stature range fitted.

Table 6
HEIGHTS OF FURNITURE
Levre School, Baerum, Norway
Conversion of Norwegian manufacturers' heights to ISO heights

		Classes 1 & 2 7–9 years	Classes 3 & 4 9–11 years	Classes 5 & 6 11–13 years
Use of 3 sizes 2 per class	Manufacturers' sizes	320/520 360/570	360/570 390/610	360/570 390/610
	ISO sizes	300/520[a] 340/580[a]	340/580[b] 380/640[c]	340/580[b] 380/640[c]
Use of 3 sizes 1 per 2 classes	Manufacturers' sizes	320/520	360/570	390/610
	ISO sizes	300/520[a]	340/580[b]	380/640[c]

Notes: a) ISO Size 2 20mm off 320mm chair
b) ISO Size 3 20mm off 360mm chair and 30mm off 610mm table
c) ISO Size 4 10mm off 390mm chair, and 20mm off 660mm table

This table clearly shows the greater difference between ISO chair and table heights, and the greater table heights generally—thus accommodating a wider stature range of each height.

Figures 49–51 in Appendix IV show the furniture layout originally proposed by the manufacturer, subsequent proposals made during the design stages, and thirdly the actual layout in use observed during the first term of the school's existence.

Table 7 presents the stature data that was obtained for the Oslo region in 1970. The same data is shown graphically in Figure 33, with the Norwegian and ISO furniture sizes related to them. (The British interpretation of stature ranges to ISO sizes is shown.) For national use in Norway it would be of value to check the relevance of the Oslo data to the whole nation, and to add data for pupils under 7 years of age. It is also considered that for school furnishing purposes the 5 & 95 percentiles define more reasonable limits.

Table 7
STATURE DATA
Stature measured in Oslo, 1970

Age (years)	Percentiles		Percentiles		Percentiles	
	2.5[a]	2.5	97.5[a]	97.5	2.5	97.5
	Boys	Girls	Boys	Girls	Combined[b]	
7	1160	1150	1360	1350	1175	1385
8	1190	1180	1400	1400	1205	1425
9	1230	1220	1460	1450	1245	1485
10	1270	1270	1510	1520	1295	1545
11	1320	1320	1570	1590	1345	1615
12	1370	1380	1640	1660	1405	1685
13	1420	1440	1720	1720	1445	1745
14	1480	1490	1880	1750	1505	1825
15	1550	1530	1860	1770	1555	1885
16	1610	1540	1890	1780	1565	1915
17	1660	1560	1910	1780	1585	1935
18	1880	1560	1920	1790	1585	1945

Notes: a) It is considered that these percentiles represent too wide a range for furniture fitting purposes. In a group of thirty pupils, about 1.5 pupils would be beyond this range. 5–95 percentiles, as suggested above, might be more appropriate.

b) These dimensions, which include 25mm for shoes, are those used in Table 5, and shown graphically in Figure 33.

Spain

In Table 8 the application of the three standard Spanish furniture sizes which would have been specified for the project school is compared with the three British sizes that were installed. With the greater heights and greater distances between seat and underside of top in the Spanish range—designed for a span of eight years—the comfort of the shorter pupils is sacrificed for that of the older ones. This is normally the situation. Observations in the school before conversion indicated that the Spanish furniture was too high; and furthermore, storage racks, which were not used, interfered with leg room. Measurements were made of boys and girls of maximum, minimum and average stature in each class and checked against the proposed British sizes, which were considered to be satisfactory provided the maximum leg clearances at each size were maintained. Unlike the Spanish sizes the lower British sizes favoured the younger pupils, but there were complaints that the 390/650 size was too low for classes 7 and 8 (i.e. 12–14 year old pupils). Accordingly the statures of the 64 pupils in class 7 and the 73 pupils in class 8 were measured.

Table 8
DISTRIBUTION OF FURNITURE SIZES

Herrera Oria School, Madrid
Comparison of Spanish and British distribution of furniture sizes

Class and Centre	Age Range (years)	Spanish Sizes Specified			British Sizes Specified and in Use		
		Size No.	Seat/Table Heights (mm)	Seat/Table Diff. (mm)	Size No.	Seat/Table Heights (mm)	Seat/Table Diff. (mm)
1 Centre 1	6–7	1	360/600	240	B	320/550	230
4 Centre 6	9–10	2	390/650	260	C	355/600	245
5 Centre 2	10–11	2	390/650	260	C	355/600	245
6 Centre 4	11–12	3	420/700	280	D	390/650	260
7 Centre 5	12–13	3	420/700	280	D	390/650	260
8 Centre 3	13–14	3	420/700	280	D	390/650	260

In Table 9, which analyses the fit for pupils in the Herrera Oria School, Madrid, the figures are calculated from 100 percentiles of the pupils selected in May 1977 (see also Appendix IV).

Figure 34 shows the application of British and Spanish furniture sizes to the statures of the same age range of pupils as set out in Table 9.

Table 9
ANALYSIS OF FIT

Herrera Oria School, Madrid
Analysis of fit for 12–13 and 13–14 year old pupils (Classes 7 & 8)

Class	Age Range (years)	Mean Stature (inc 10 mm for shoes)	Std. Dev.	% Fit Size 'D' 390/650	% Fit Size 'E' 430/700
7	12–13	1610	73	71 4–75%ile	34 65–99%ile
8	13–14	1630	73	64 2–66% ile	44 56–99.9% ile

Both Table 9 and Figure 34 show that for the best fitting two sizes would be preferable in each class. The Table also shows that if a single size were chosen for both classes, the 390/650 choice would be preferable on numerical grounds, fitting 71% and 64% (rather than 34% and 44%) of the 12–13 year and 13–14 year ranges respectively. The introduction of a fourth size into the school increases the possibility of mis-matching and mis-fitting if the furniture is moved, or the pupils move to a different place.

When considering a single size one has to decide where a degree of mis-fitting can best be tolerated. As the complaints are usually made by pupils whose furniture is too low rather than too high, a compromise would have been to provide size 390/650 (in Class 7) for the 12–13 year olds, and size 430/700 (in Class 8) for the 13–14 year olds. The choice of favouring either the shorter or the taller pupils is shown in Figure 34. Finally, the statures for these 12–14 year pupils appear to be too high (for Comparison see the correspondin data for Norway and the United Kingdom, figures 32 and 33) and measurements on a wider scale are required before conclusions can be reached on the distribution of sizes in Spain.

NOTES

1. *a)* "Furniture and Fittings: British Standards School Furniture", *Architects Journal*, 12 January 1956, pp. 59–63.
   b) E.R. Robson, *School Architecture*, Murray, London, 1877, Chapter 18.

2. *a)* *Building Bulletin 16*, "Development Projects: Junior School, Amersham" HMSO, London, 1958. See Diagram 1 and paras 28–99 for description of the first attempted installation of a co-ordinated furniture range, which conformed with a new British Standards Specification.
   b) *Building Bulletin 3*, "Village Schools", HMSO, London, 1961. See para 40, Diagrams 4–7 and plates 2–8 for information on an extension of the range mentioned in Note 2 a) above.
   c) *Building Bulletin 36*, "Eveline Lowe Primary School London", HMSO, London, 1967. See Chapter 5 and Appendix 2 for detailed description of a co-ordinated range more fully developed.
   d) *Design Studies No 2*, "Ysgol y Dderi: An Area School in Dyfed", Welsh Office, Education Department, 1976. This gives details of the most recent development published for a co-ordinated range.

3. Stella Duncan, "A Child and his Growth", *Trends*, Department of Education and Science, London, February 1970.

4 *Building Bulletin 52*, "School Furniture: Standing and Sitting Postures", HMSO, London, 1975.

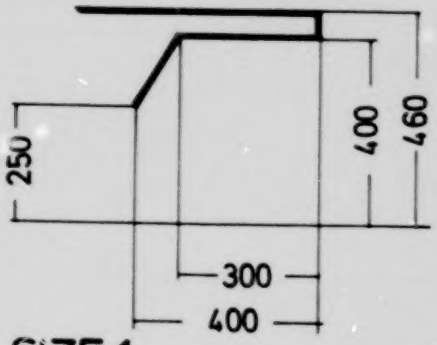
5. Data derived from:
   Building Bulletin 46, "British School Population Dimensional Survey, 1971", HMSO, London, 1972.

6. *Building Bulletin 46, op. cit.*

7. *Acta Pediatrica Scandinavica 64*, 1975, pp 565–573.

Figure 31 MINIMUM LEG CLEARING ZONES
British Standard (BS)
Interpretation of ISO Requirements

Minimum leg clearances for the school population in the United Kingdom at each of the ISO sitting heights.



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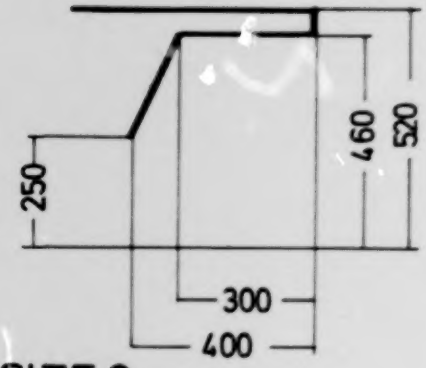
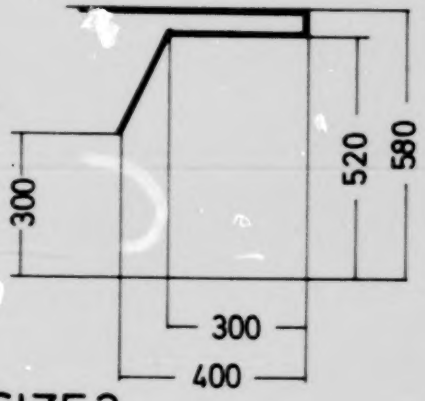
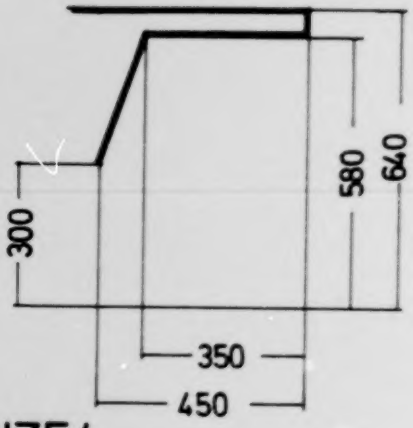


SIZE 2



SIZE 3



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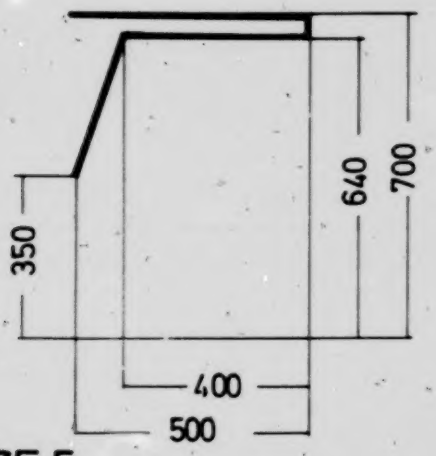


SIZE 5

Figure 32 UK STATURE DATA
Fitting to ISO Furniture Sizes

This shows the statures of the school population in the United Kingdom, and how the proposed British Standard, based on the ISO draft Standard, relates to them.

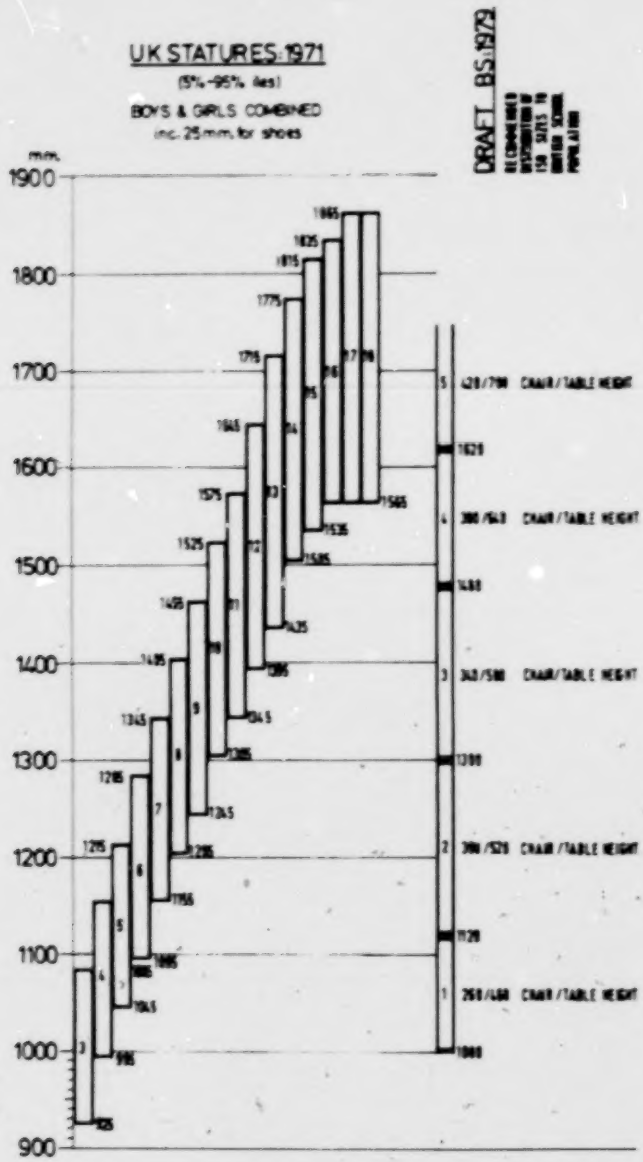


Figure 32A UK STATURE DATA
% Distribution of BS/ISO Furniture Sizes

This shows the proportions of each United Kingdom stature and age groups fitted by each of the five BS/ISO sizes.

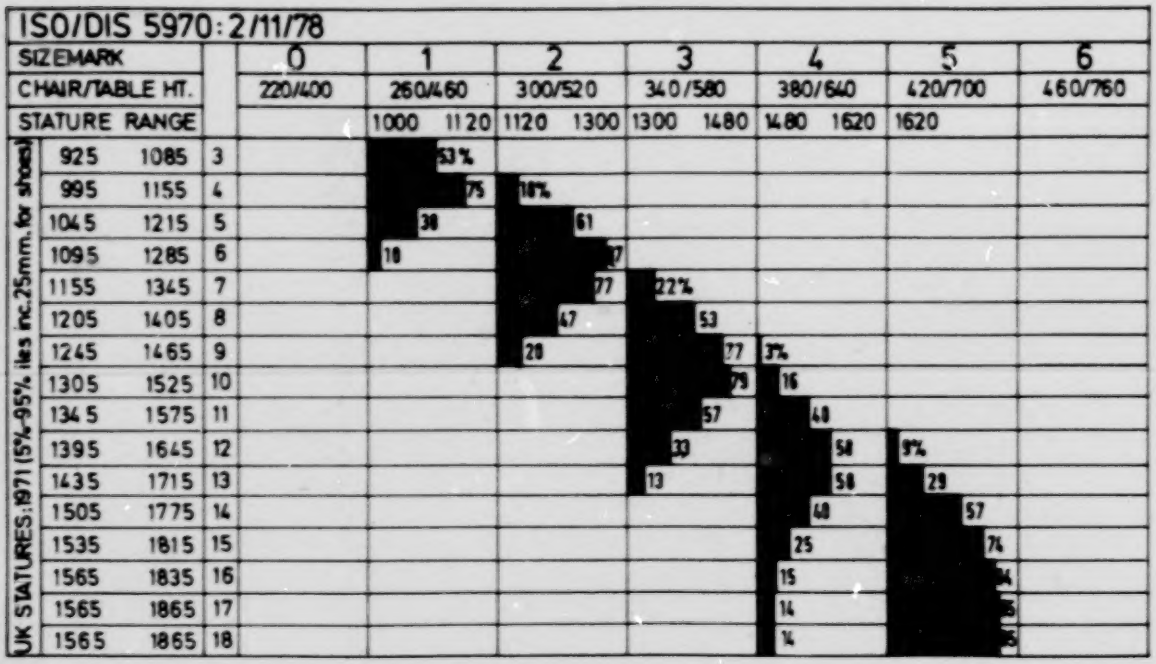


Figure 33 STATURE DATA (Oslo 1970)
Fitting to Norwegian and ISO Furniture Sizes

Stature data for the Oslo region (1970), and fitting of Norwegian and ISO furniture sizes compared.

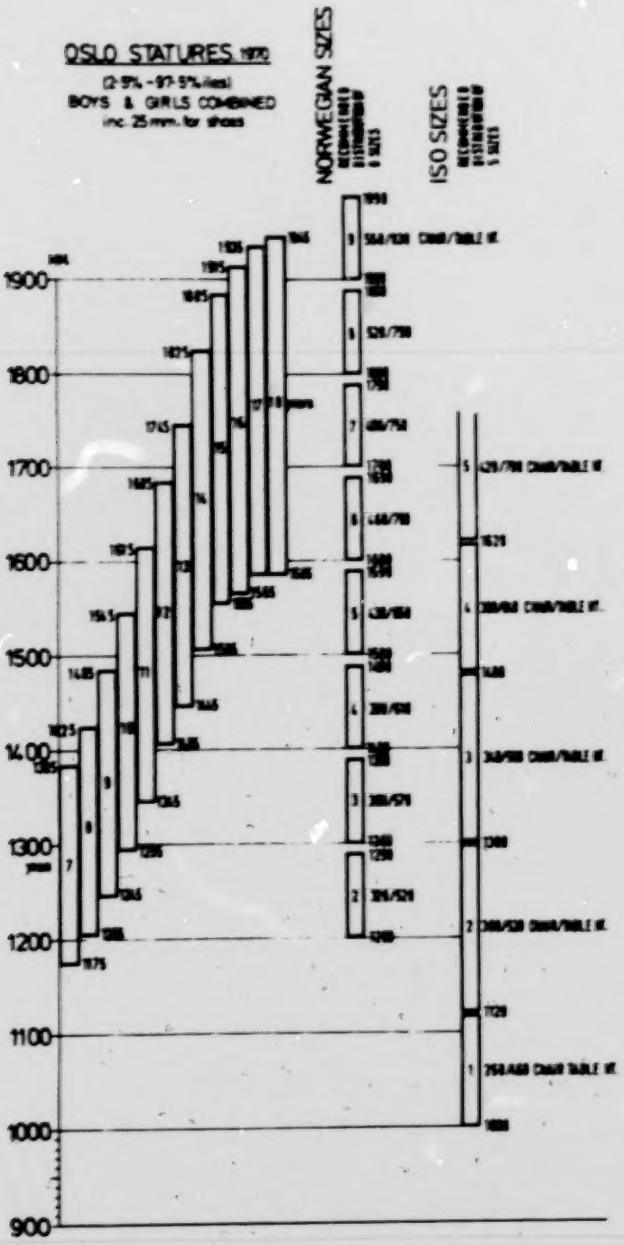
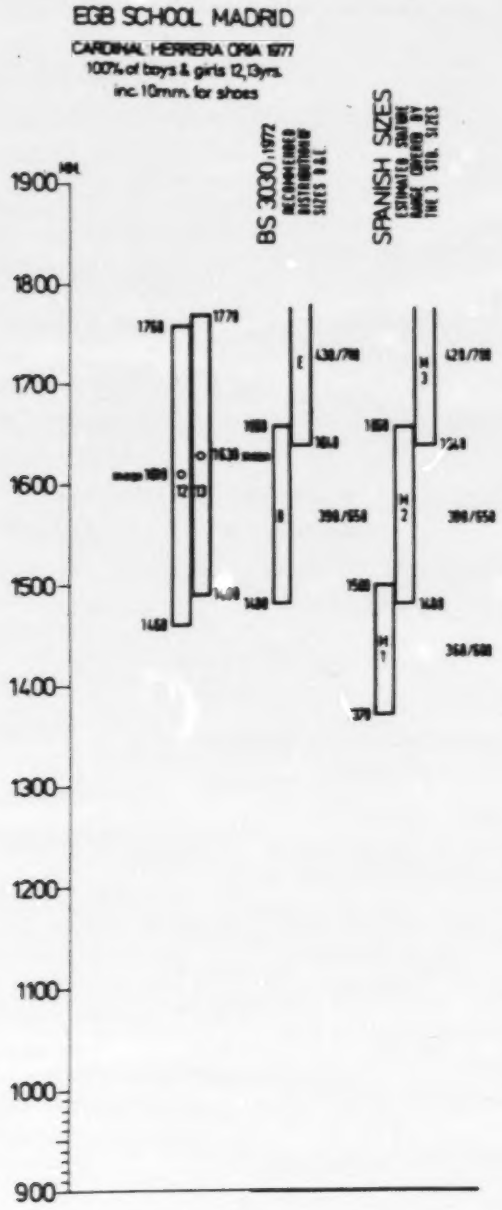


Figure 34 STATURE DATA (Madrid 1977) Furniture Sizes for 12 and 13 Years

This illustrates the application of British and Spanish furniture sizes, as discussed in the text.

The diagram does not represent the percentage of pupils covered by a furniture size, as indicated in Table 9, because pupils' stature are not evenly distributed through the stature range. The three Spanish furniture sizes do not cater for children below about 8 1/2 years.



131

Appendix III

DIMENSIONAL DATA: SOME EXAMPLES

In Part Two, in which characteristics of school furniture were discussed, three categories of dimensional influence were defined. One of these, concerned with economic factors, is not relevant here, but some British data on the other two—anthropometric and ergonomic influences, and the sizes of items in common use— are included here. The first example is data on sitting and standing measurements for design; the second is data on certain items of pupils' personal belongings for which storage is needed.

SITTING AND STANDING MEASUREMENTS FOR DESIGN

It is important to stress that such data should be prepared for different national school populations, and that this should not be confined to measurements which have only medical relevance, but are relevant to actual dynamic situations in schools, as are those shown in Figures 35 to 39.[1].

The dimensions are for boys and girls combined. Heights define 5–95 percentile limits. Standing and popliteus heights include 25 mm for shoes. Sitting heights are best single heights for the age range (ref. ISO/DIS 5970: 1978). Standing heights (for general purposes) include four ISO/DIS 5970 sitting heights (580, 640, 700 and 760), plus three heights at 60mm increments (820, 880 and 940).

STORAGE OF PUPILS' BAGS AND COATS

Items in common use, both teaching and personal, are too numerous to be studied in this report. They could range from cassettes to gymnastic equipment, from rubber boots to electric polishers. But they all have to be accommodated, either by provision made by fixtures in the building itself, or by furniture. One range of items only has been selected for presentation here: pupils' bags and coats, for which the storage is a problem that was encountered in all the projects and schools visited, and is indeed a widespread one.

The source of the information shown in Figures 40 and 41 is a study made by the Furniture Industry Research Association (FIRA) for the Department of Education and Science in London.[2] In this study the reasons why the familiar provision of various kinds no longer serves are analysed, as are the results of surveys to find out what is actually brought to school (in England and Wales now) by pupils of all ages. For a number of reasons the solution does not seem to be to provide lockers in concentrations, nor to provide for books and miscellaneous items in the furniture at the work place. Assuming that the present practice of littering the floors and worktops with bags and coats is not to be condoned, it is advisable to make some local, rather than central provision in the form of plinths, shelves, racks or trolleys.

Nursery and Primary School (3½–11 years), Montgomery, Powys
One of the many examples — and not the most extreme — where failure to use anthropometric evidence discourages and makes very awkward the performance of day to day activity

County Primary School (5–11 years), Finmere, Oxon
Sitting and standing work, and reaching over the sink and to cupboards have determined the dimensions of the furniture and then the elements of the building with which it is associated. It looks right because it is right.

1. The source of the data is
   a) *Building Bulletin 38*, "School Furniture Dimensions: Standing and Reaching", Second Edition (metric), HMSO, London, 1974.
   b) *Building Bulletin 46*, "British School Population Dimensional Survey, 1971", HMSO, London, 1972.

   Additional data are available in:–
   c) *Building Bulletin 44*, "Furniture and Equipment Dimensions: Further and Higher Education, 18–25 Age Group", HMSO, London, 1970.
   d) *Building Bulletin 50*, "Furniture and Equipment: Working Heights and Zones for Practical Activities", HMSO, London, 1973.

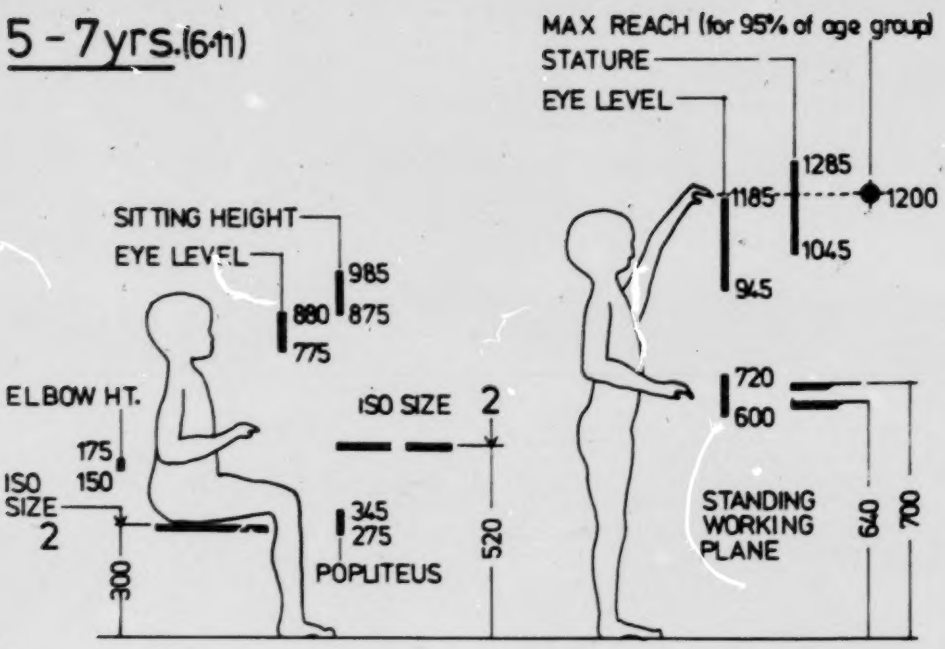
2. *Building Bulletin 58*, "Storage of Pupil's Personal Belongings", HMSO, London, 1980.

All these Building Bulletins are the published results of research by the Furniture Industry Research Association (FIRA) for the Department of Education and Science.

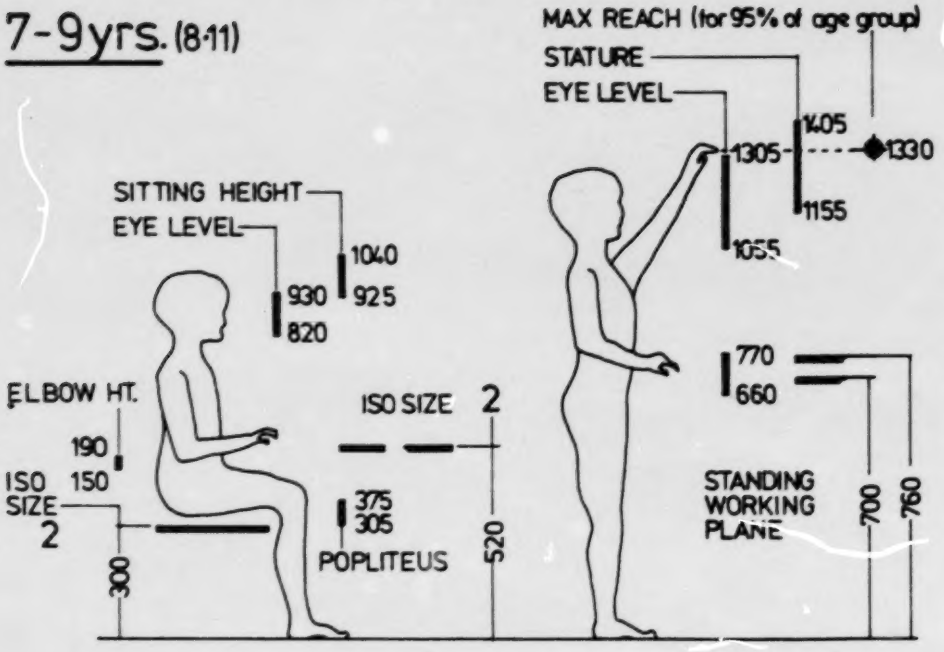
Figures 35–39 SIZES OF PUPILS AND FURNITURE 3–18 Years

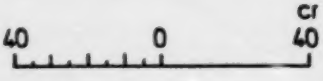
For the source of this data see Note 1. of the Notes to Appendix III.

5 - 7yrs. (6-11)

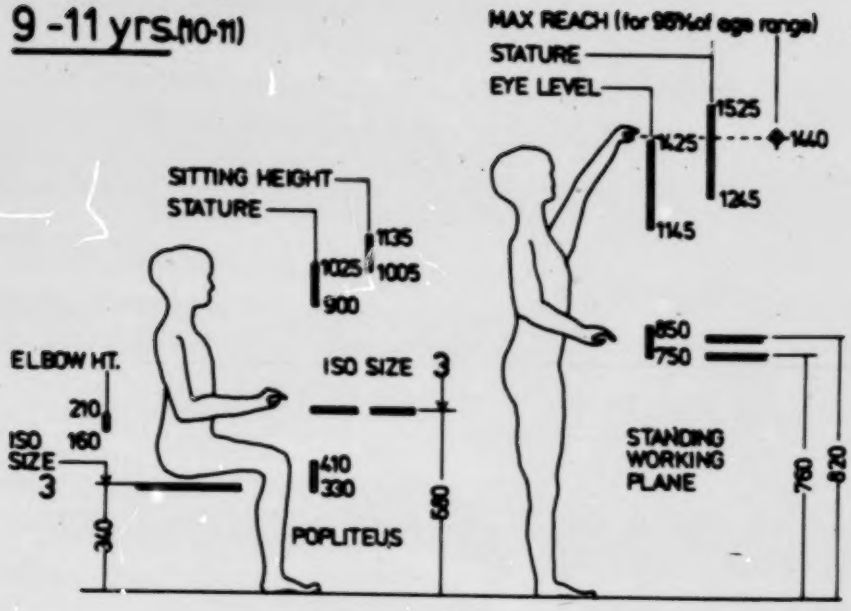


7-9yrs. (8-11)

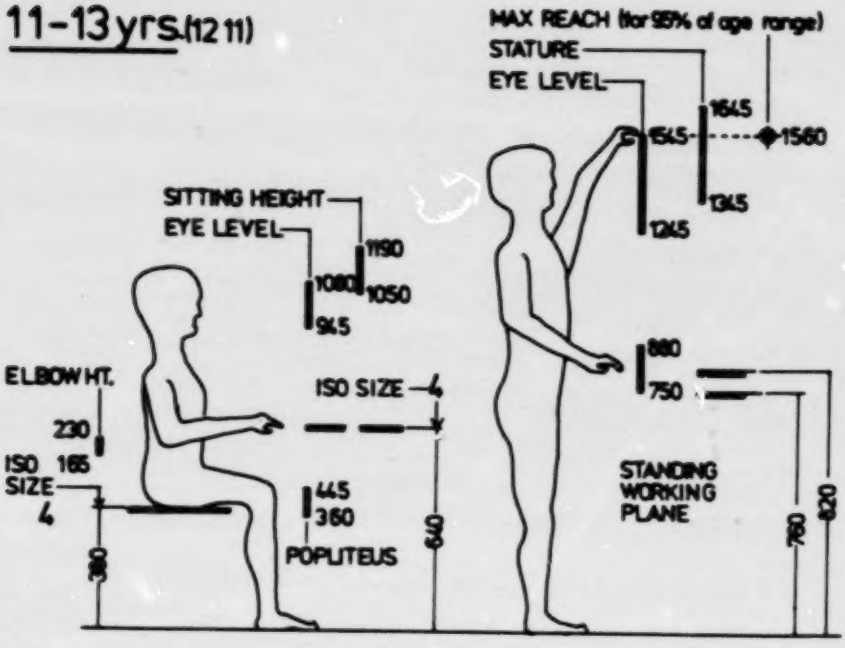




9 -11 yrs.(10-11)

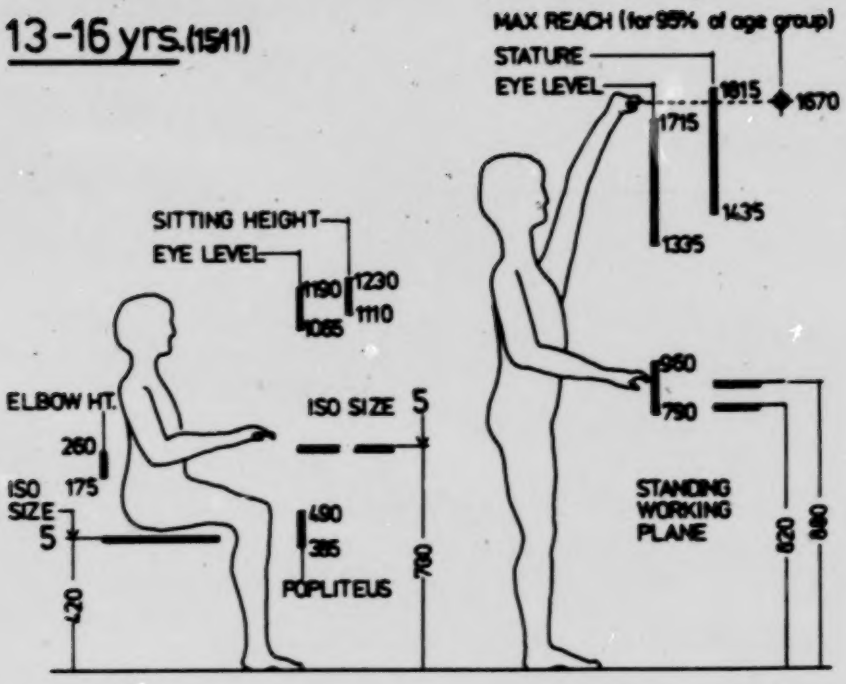


11-13 yrs.(12 11)

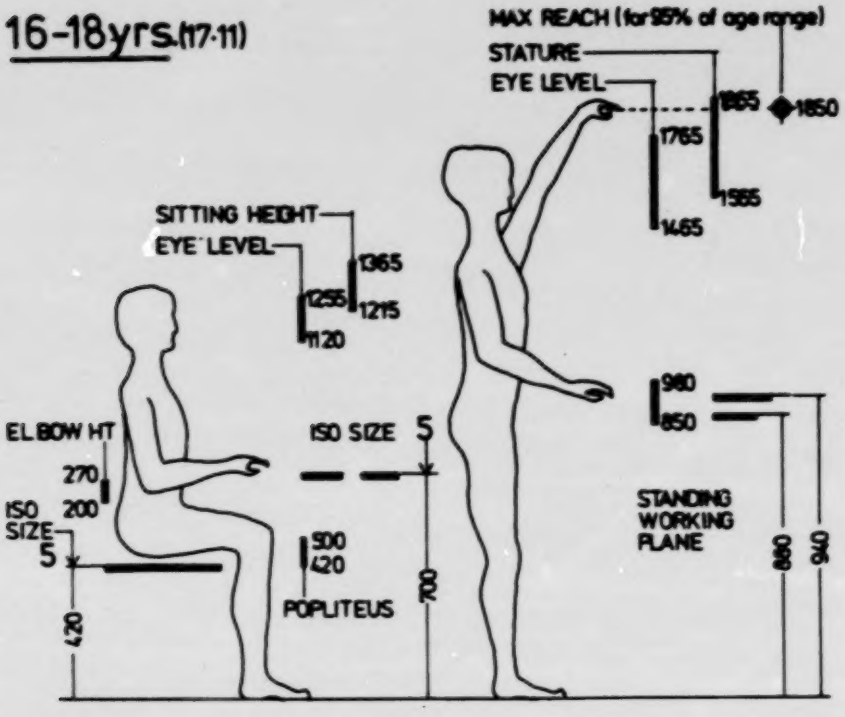


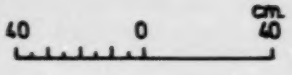
40 0

13-16 yrs. (15·11)

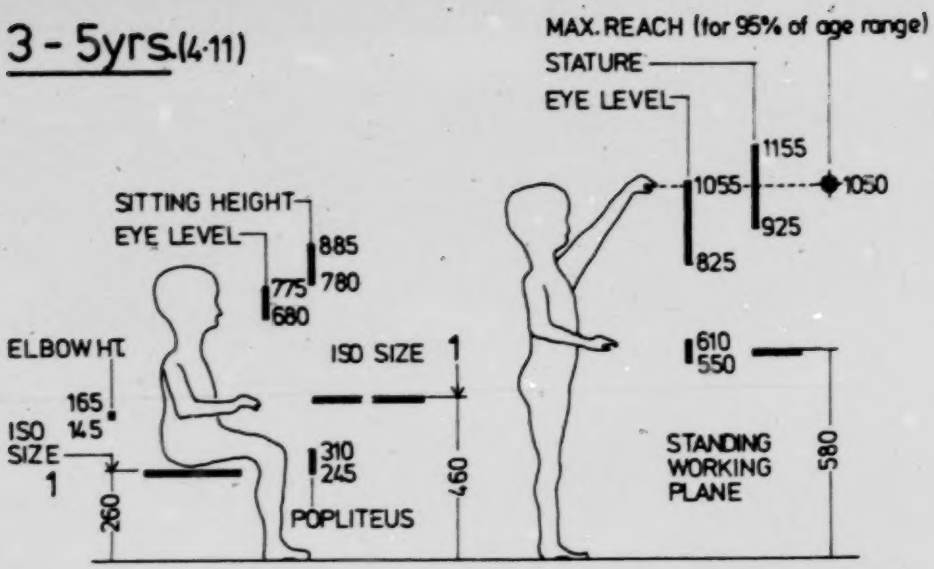


16-18 yrs. (17·11)

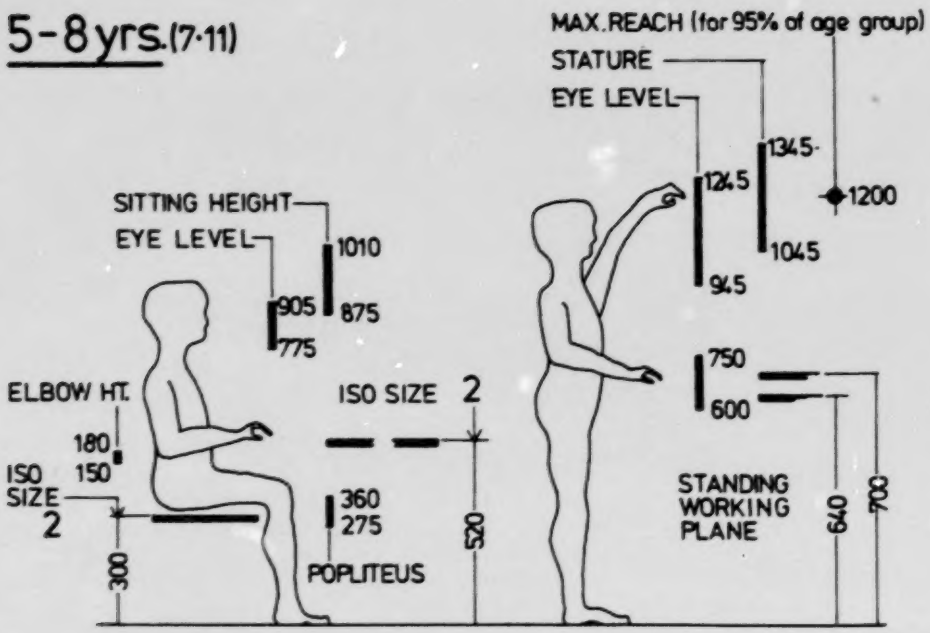


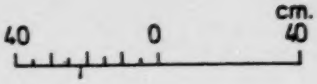


3 - 5yrs.(4·11)

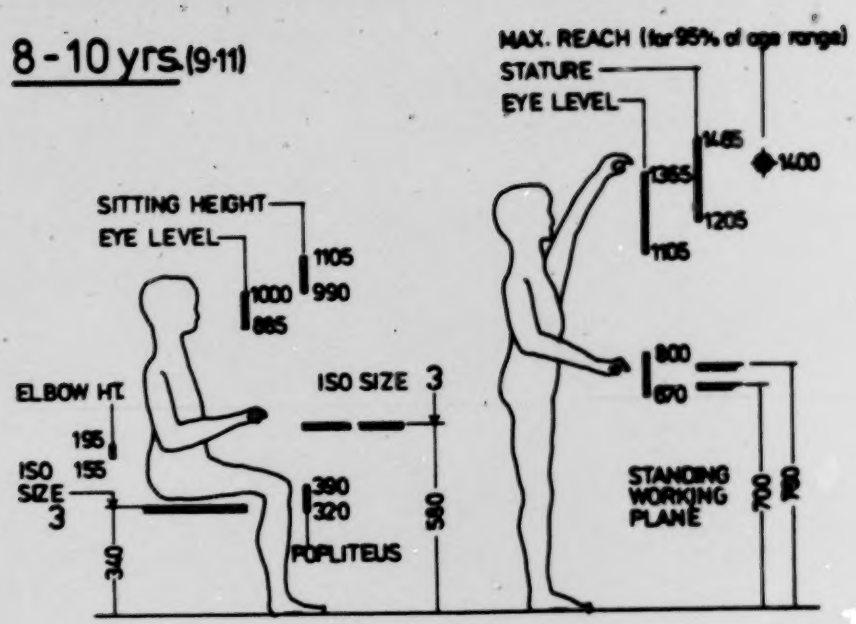


5 - 8yrs.(7·11)

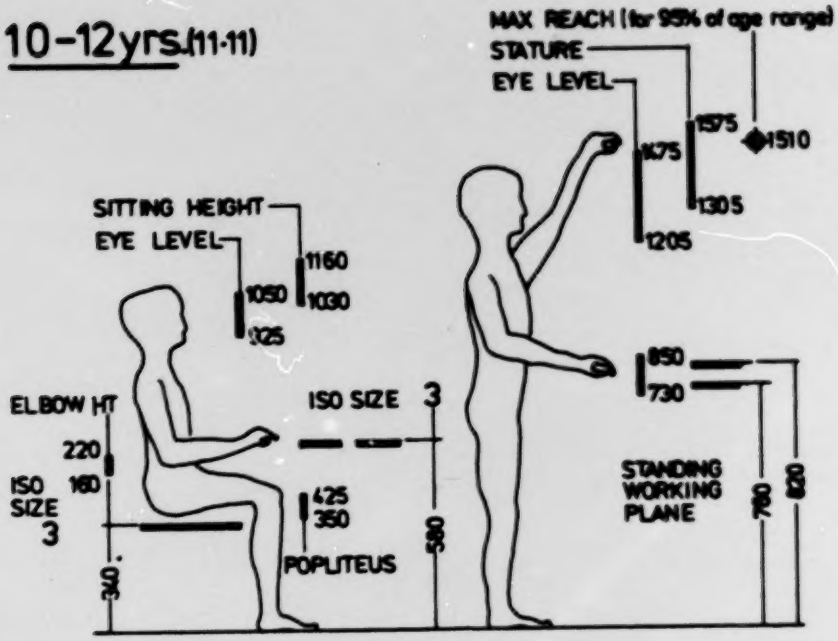




8 - 10 yrs. (9·11)



10 - 12 yrs. (11·11)



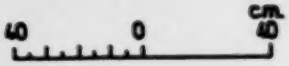
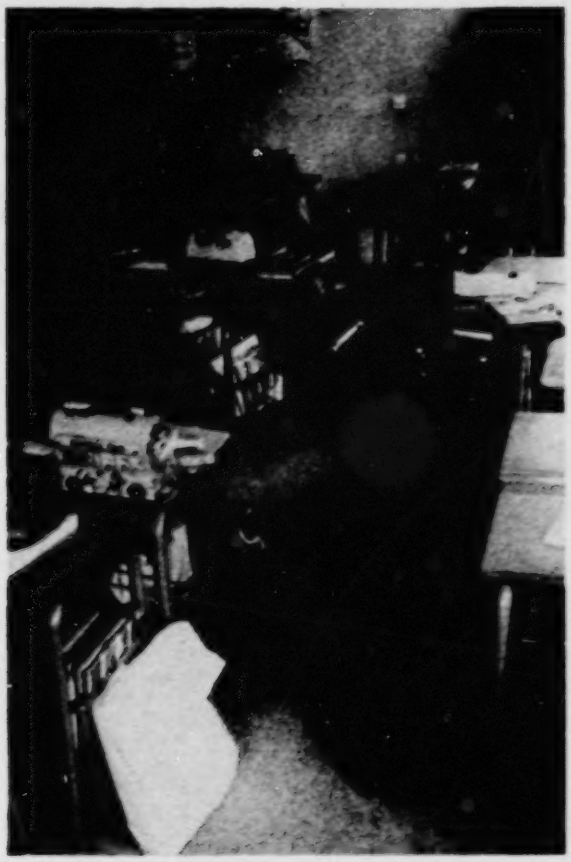
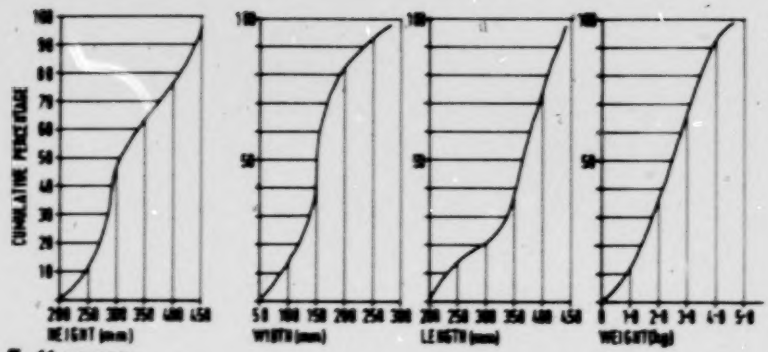


Figure 40 PUPILS' BAGS (1977 Survey) Size, Weight and Distribution

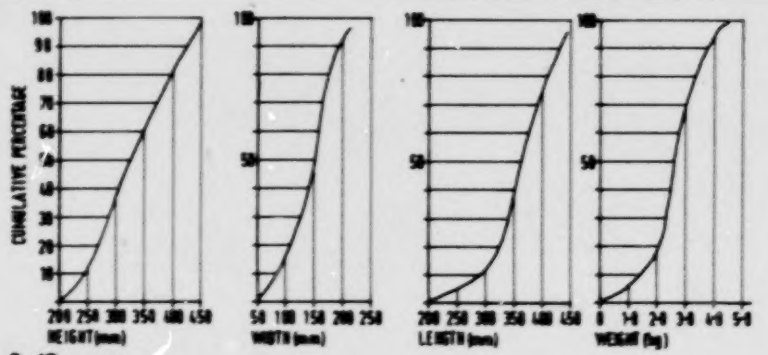
This data is from a survey made in England and Wales in 1977.



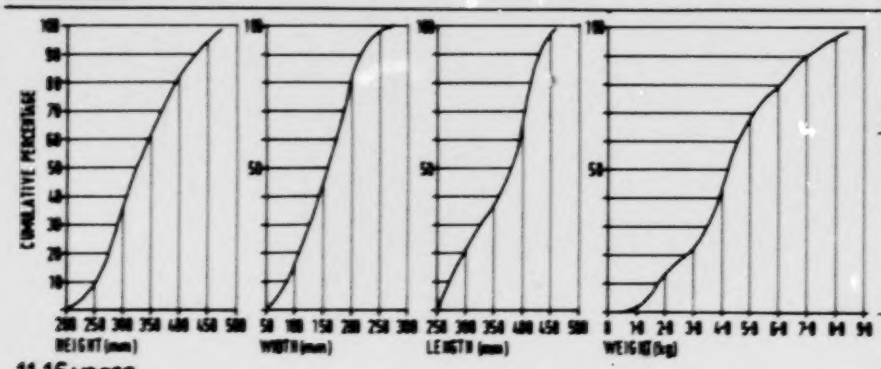
Escuela Aguirre (6–14 years), Madrid
The first step in dealing with the clutter of miscellaneous bags etc. is to be armed with reliable dimensional data. Then, racks, shelves and lockers etc. can be suitably sized. Where and how to deploy them requires study of the organisation of the particular school and the collaboration of teachers and pupils.



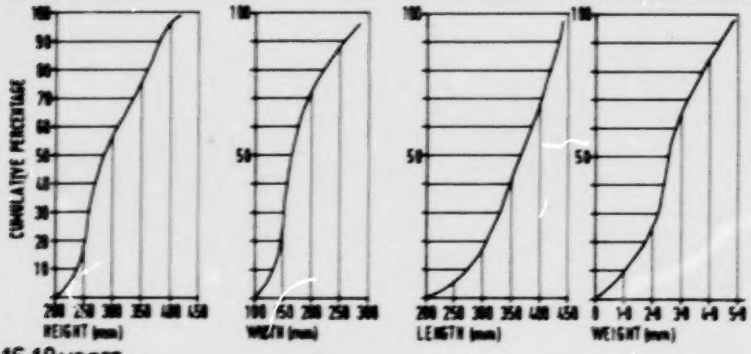
5-11 years



8-13 years



11-16 years



16-18 years

SPORTS BAG	AGE RANGE (yrs)	%
	5-11	33
	8-13	49
	11-16	31
	16-18	15

BRIEFCASE		
	5-11	8
	8-13	5
	11-16	22
	16-18	38

TOTE BAG		
	5-11	31
	8-13	32
	11-16	26
	16-18	36

DUFFLE BAG		
	5-11	-
	8-13	3
	11-16	-
	16-18	-

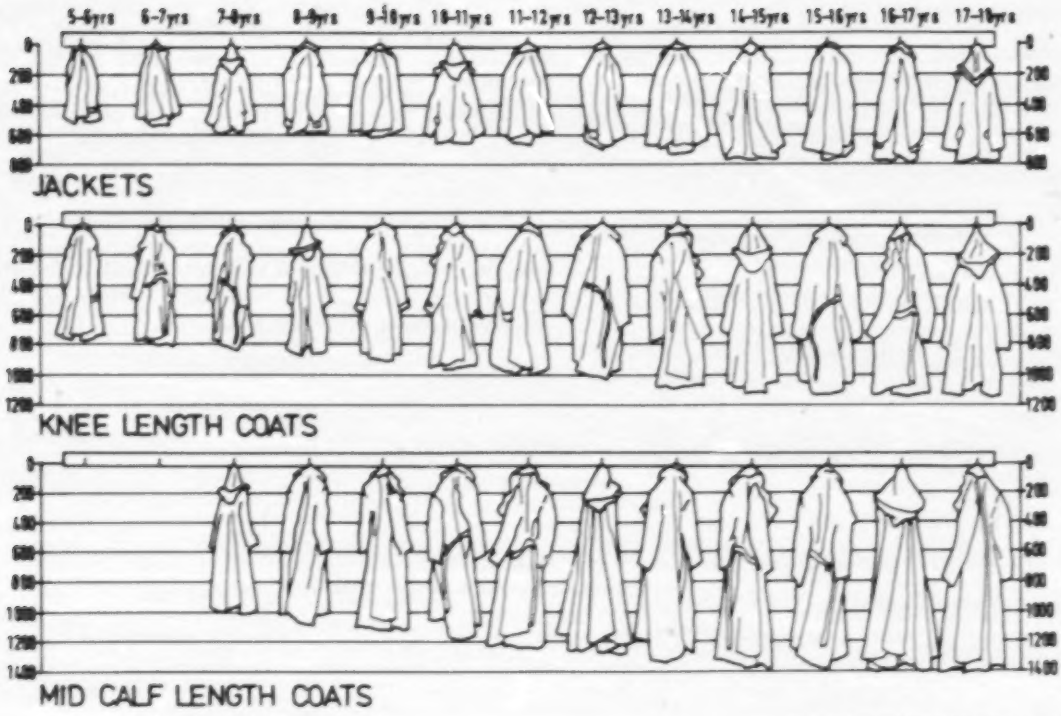
PLASTIC CARRIER BAG		
	5-11	9
	8-13	11
	11-16	7
	16-18	2

SATCHEL		
	5-11	19
	8-13	-
	11-16	14
	16-18	9

DISTRIBUTION OF BAG TYPE

Figure 41 LENGTHS OF PUPILS' COATS (1977 Survey)

This data is from a survey made in England & Wales in 1977. For coats which are hung from hooks, an allowance of 200–300 mm should be made.



ONLY 5% OF COATS WILL BE LONGER THAN SHOWN.

Appendix IV

DESCRIPTION OF TWO PROJECTS

The different sources of this report were outlined in the Introduction. Of the three projects undertaken—in Portugal, Spain and Norway—the first was concerned with the design of a new range of furniture for middle schools, which was tested in a new school and is now in regular supply. In the two others there were detailed discussions on new installations for proposed educational changes: one in an adapted school, the other in a new building. As both these illustrate a number of general points made in Part One, and more particular points in Part Two and Appendix II, they are described and illustrated here.

SPAIN

Background

The Ministry of Education was considering planning modifications and the re-furnishing of part of a school designated as one of the "experimental" schools of the Instituto de Ciencias de Educación (ICE) of the Universidad Autonoma, Madrid. An aim of the "experiment" was to compare the performance of the existing curriculum in unmodified 'control' classrooms, with that of a new curriculum in adapted and newly furnished centres.

The school: Cardinal Herrera Oria EGB (General Basic Education) School was designed in 1969/70 for 640 pupils aged 6–14 years. In may 1976, when first visited, there were 880 pupils—excluding 140 pupils in the adjacent pre-school. The concrete frame building, three storeys high, was on a confined site, surrounded by hard playgrounds and tall blocks of flats, in the northwest suburbs of Madrid.

Six "centres", each for about 70 pupils and two teachers, were to be planned and furnished to replace single classrooms furnished only with chairs and single desks, a teacher's desk and chair, a cupboard and a chalkboard. At the time of the first visit modifications to the planning had already started, but minor additional alterations were suggested. The project, therefore, included planning modifications and the design of furniture layouts, the installation of which was made early in 1977 and put into use during subsequent months—but more slowly than planned because of changes in policy and staff.

The Proposed Layouts

The layouts which were proposed and agreed with the Head and teaching staff, aimed to make possible a greater variety of work "locally" in centres, with less use of special subject rooms; and to provide, therefore, in varying ways for:

- collective tablework in large groups for direct teaching;
- practical work for individual and small groups;
- study for individuals and small groups.

The layouts were influenced by the following objectives:

a) a single height of chair and sitting height table throughout each centre, to facilitate re-arrangments and grouping;

b) the use of oblong, square, trapezoidal and round tables of compatible plan sizes, again to facilitate grouping;

c) the avoidance of storage at sitting height work places, in order not to inhibit flexibility of use;

d) the provision of furniture both for sitting and of standing height; the latter for practical work of various kinds in the form of perimeter worktops and free-standing tables; (no furniture on the floor fixed to the building);

e) the provision of mobile display and storage items for personal belongings, teaching material, books and pupils' work;

f) provision of wall-mounted equipment for two and three dimensional display and storage.

The layouts of each centre are shown in Figures 42–45:

Centre 1 (Figure 42)

a) Area: 1.6sq.m per pupil at 70 pupils. This area is rather low, and a maximum of 60 pupils (1.8sq.m per pupil) would be advisable.

b) Suggested modifications to the building:
- Move the door in northwest corner away from wall to permit worktop to be extended to give a corresponding increase in working area.
- Provide sink (water available from adjacent lavatory). Note: the absence of water in the classrooms throughout the school limits the range of work that can be done in them.
- Replace long sliding-folding doors by short flanks to give more working and display surfaces, and to make it possible to provide a store.

Centre 2 (Figure 43)

a) Area: 2.3sq.m per pupil at 70 pupils.

b) Suggested modifications to the building:
- Form flanks to create bays for the location of small groups. (This was not done; flanks were formed by divider storage units.)
- Form opening between rooms 2 and 3. (This was not done.)

Centres 3 and 4 (Figure 44)

a) Area: 1.77sq.m per pupil at 70 pupils in each centre.

b) Suggested modification to the building: The authority's proposal to subdivide each room by a sliding-folding partition between window and column was discouraged. This, it was felt, would have been acoustically ineffective, and without it, more variety of furniture arrangements would give better educational value. Also the resulting proportions and lighting would have been uncomfortable.

Centres 5 and 6 (Figure 45)

a) Area: 2.81sq.m per pupil at 70 pupils in each centre.

b) Suggested modification to the building: Normal doors would be more convenient than sliding doors to Rooms 1 and 2, particularly if they had glazed panels. In centres which have more rooms than teachers, it is clearly an advantage to see whether rooms are occupied.

The New Layout in Centre 2: First Reactions

The first of two subsequent visits was made in May 1977. Because of staff changes and reorganisation it was too early to draw conclusions. However, the points noted below were gathered from discussions with teachers who had been working in the adapted centres and had been associated with the new curriculum from the beginning. They had analysed their own, and their pupils' reactions very thoroughly. Figure 46 indicates the various arrangements and groupings which were recorded during the course of one day, and which can be compared with the layout as originally proposed (see Figure 43), with almost the same furniture in use.

Immediately one was struck by the release of opportunity provided by the variety of space and furniture. One was surrounded not by a bald interior, but by the evidence of purposeful work. Indeed, the open display of work and books had already given rise to the claim that pupils were using and reading books more. The encouragement of grouping led to the spontaneous helping of a slow learner by more able pupils. And the three layouts show how the disposition of pupils can vary in a short time in response to the work. The versatility of a pair of top pivotted chalkboards, to which one could clip and pin, was preferred to a single flat chalkboard 2400mm long. It was felt that the display fittings could with advantage be supplemented by more generous pinning surfaces. (This was noted as a building adaptation rather than a furnishing point.) Circular and trapezoidal tables were less popular than rectangular ones: this was partly due to familiarity with the existing 600 × 420mm single desks; and partly because trapezoidal tables were associated in the pupils' minds with younger pupils than themselves, or were regarded as a supplement to rectangular tables. Large circular (and square tables) are usually preferred in locations such as bays and

focal points, rather than in open spaces where they tend to float obtrusively amongst the others, and are tiresome to move frequently. Finally, the storage provided for pupils' bags made the rooms more tidy, and did not restrict movement.

In time, it was felt, familiarity with a novel and complex schedule of furniture could lead to more skilful articulation of activity.

A second visit was made in January 1978 to the same Centre 2. In the meantime the two teachers, who had been associated with the new curriculum from the start and had worked with furniture layouts (ref. Figure 46) had left; and two new teachers under a new Head (not previously associated with the project) were in charge. The number of pupils had increased from 68 to 78.

Figure 47 shows the arrangement of furniture in the Centre at that date. It was observed that the small rooms—part of the Centre—were not being used, and that the large space had been rearranged in the form of two independent classrooms, each for 30–40 pupils and separated by a crush of furniture which was not conveniently arranged for use. Some old single desks and chairs had been brought in to make up the number of places. The density of occupation by each group was very unequal, and it would appear that the way of working was already reverting to methods which the project was originally designed to replace. In such circumstances it is doubtful whether a fair comparison between the 'control' classrooms and the newly planned and furnished Centres can be assessed.

NORWAY

Background

The local authority of Baerum Kommune, on the western border of Oslo, wanted with the Ministry of Church and Education (KUD) to encourage educational development through the planning and furnishing of a new school.

The school: Levre School, Baerum Kommune, was designed in 1975/76 and opened in 1977. The school was planned for 360 pupils aged 7–13 years, plus a group of 20 pupils aged 6–7 years (førskole) i.e. one year prior to the start of compulsory education. (This was an innovation.) There is an adjacent pre-school (barnehage) and free-time home (fritidshjem), both of which are administered by the Social Services Department, but in this special case are under the Head of the main school.

The project included the furniture layout of the three wings of the school—one wing for each of three two-year age groups of pupils (7–9 years; 9–11 years and 11–13 years)—i.e. 120 pupils in each wing. The 6–7 year group room is situated at the end of the 7–9 year pupils' wing. Authority was given to nominate the furniture manufacturer at the start of the project. Figure 48 shows the whole school and its relation to the pre-school and free-time home building. The planning of each of the three wings mentioned above is in the form of a vestigial central corridor, with positions for movable partitions on either side to permit various sub-divisions of space—which can include areas for normal classrooms. Primarily this "flexibility" was intended to provide for teaching groups of 20, 30 or 60 pupils up to a total of 120 pupils, with about four teachers. In addition the following separate subject rooms are provided:

a) for homecrafts;
b) for craftwork in wood, metal, clay;
c) for music;
d) for physical education (and drama etc).

There is also a separate room for films, a library and study area. These are all shaded on the plan to indicate that they are shared, not "local" work areas.

The Proposed Layouts

The evolution of the layouts involved detailed discussions on planning and furniture, and can be summarised in five stages. Layouts at each of these stages were prepared for the three wings of the school described above, but only those for one wing are illustrated in the following Figures 49, 50 and 51:

a) Manufacturer's layout — See Figure 49
Before consultation 1976
b) Local Authority's layout — See Figure 49
After consultation 1976
c) Proposed layout — See Figure 50
Without planning alterations
d) Proposed layout — See Figure 50
With minor planning alterations
e) Finally negotiated layout — See Figure 51
May 1977

a) Manufacturer's layout (Figure 49)
Before consultation, 1976

This plan shows the wing for 120 pupils aged 7–9 years, plus the 20 pupils aged 6–7 years. It

illustrates a common procedure when the furniture layout is not the responsibility of the architect of the school, and when the local authority does not employ professional staff for the purpose. The manufacturer cannot be aware of educational developments, and can only deploy a pattern of sitting height tables, selected from their catalogue, for a given number of pupils. No criticism of the manufacturer is implied by this observation.

b) *Local authority's layout* (Figure 49)
After consultation, 1976

This proposal, prepared after discussions between the local authority and the architect, indicates a departure from the manufacturer's layout. Some standing height worktops are included by the sinks; there are some bench seats in the small bays; there are book trolleys and free-standing storage cupboards, with complements of trays and shelves.

The most striking feature of the layouts at this stage, when all three wings are examined, is that 435 sitting height table places and chairs have been provided for 360+20 pupils. These places exclude those provided by bench seats in bays, standing working places, and others in the library and the separate subject rooms. It is an example of too much furniture, and insufficient variety. The number of sitting places is particularly excessive in the wings for the 9–11 and 11–13 year pupils, from which there will be more departures to separate subject rooms. (Some of the sitting height furniture impinges closely on the sinks.)

c) *Proposed layout* (Figure 50)
Without planning alterations

The purpose of this layout was similar to that described below under d). It became evident that it was too late to make the small planning modifications suggested there. By comparison, the practical areas are cramped, as is the arrangement for the 6–7 year old group; and the position of the door linking this group to the older pupils does not permit the convenient use of space on either side.

d) *Proposed layout* (Figure 50)
With minor planning alterations

Since the space for the 20 pupils aged 6–7 years was very restricted, and it was likely that their work and that of the older pupils could overlap with advantage, a link past a small shared group room and a store was suggested.

For the other 7–8 year olds there is an enclosed room for up to 20 pupils, with provision for messy practical work and for book work. There are places for small groups using audio-visual equipment and for groups of up to about ten pupils working on their own or with a teacher, in the adjacent bay.

For the 8 year olds the layout (south of the "corridor") for up to 60 pupils and two or three teachers, has a central focus for display, materials, books and collections of pupils' work, where quick reference can be made as the need arises. There are bays for small study groups and small-scale projects, from which there is direct access to larger spaces equipped both for books and for practical work.

It was not intended that the arrangement of the furniture and the partitions should remain as shown. (Nor are the partitions fixed, but are suggested locations of the 1150mm wide movable panels.) The plan indicates a starting point, however, which has an educational basis. All the teachers in this wing could use the full range of opportunities provided, instead of being restricted to what could be fitted into self-contained classrooms. Individual teachers could nevertheless work at times with a group of 30 pupils—but not all three teachers simultaneously.

The most radical planning alteration was the turning of the stores at right angles to the positions originally planned, in order to increase the size of the practical areas by the sinks, and to give them more definition. Although this change was preferred, it was not made because it would apparently have interrupted the building operation (although at the time it was only at foundation stage).

e) *Finally negotiated layout* (Figure 51)
The Layout is again the one proposed for the same wing.

At this stage the negotiations had involved the recently appointed Head, and the conflict between educational expectations and teaching reality became very clear. This is made particularly evident in the finally agreed arrangements shown diagrammatically in Figure 52 for the other two wings (i.e. for the 9–11 year and 11–13 year pupils).

The Layouts Observed during the First Term in Use

The actual layouts of the three wings in use were recorded in January 1978, and are shown in Figures 51 and 53. These layouts are by no means a fair outcome of the project, but they are an indication of reality. The school was not at that

time fully occupied and was temporarily accommodating some children from a neighbouring preschool which had been damaged by fire. There were also some children receiving special education.

In Figure 51, for example, the centre designed for 120 pupils of 7–9 years plus 20 pupils of 6–7 years was at that time occupied by 111 pupils of 7–9 years and 12 children of 1½–3 years. Four regular Norwegian chair/table heights were in use:

320/520mm
360/570mm
390/610mm
490/750mm (for the teachers)

In addition there were two special chair/table heights:

300/540mm
390/540mm

These heights excluded those of bench seats (350mm high) and of worktops (730mm high). At the time of the visit, 39 places did not conform to the regular Norwegian chair/table recommended heights, i.e. they were mis-matched.

The three Norwegian chair/table heights were being used by the 7–9 year group, for whom two heights (with greater clearance between chair and underside of table top) would have been adequate.

Two of the regular heights were being used by the 1½–3 year group, for whom they were too high. The inevitable mis-matching caused worse fitting than would have been caused by fewer sizes appropriately designed and distributed.

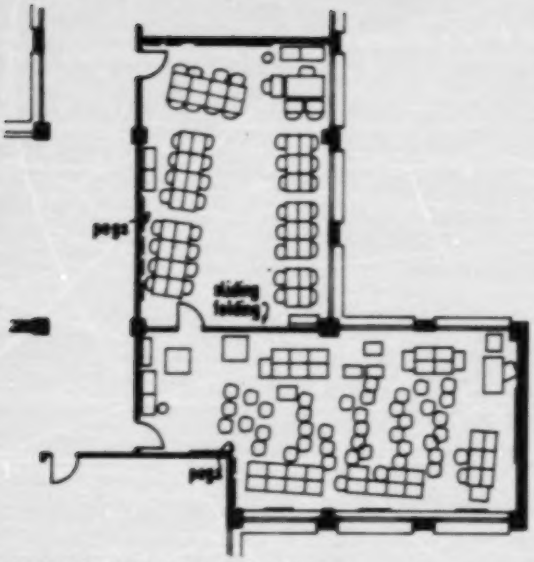
This is an illustration of the problem discussed in Appendix II, under the heading "The number of sizes", and also under the heading "Norway".

Similar problems of mis-matching furniture were evident in the other two wings designed for the 9–11 year and 11–13 year old pupils. These were temporarily occupied, in January 1978, by small groups of younger pupils. The layouts as recorded at that time are shown in Figure 53.

Strong support for the aims of the Project was at all times given by the KUD Inspectorate concerned, the local authority officers, and the Head. When there has been an uninterrupted period of experience with the planned enrolment and the full complement of teachers, evidence of the aims of the project may well be stronger. It should not be judged in isolation from its progeny, for which it is necessary to wait.

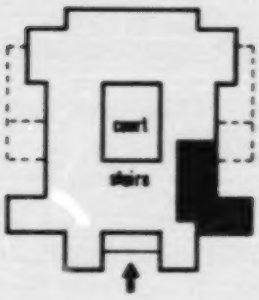
This situation has been fully recorded in order to underline the hazards that beset development work, and the careful control that needs to be exercised by administration if the longer term benefits of an individual project—to which special attention has been given—are not to be compromised by expediency, however demanding this may be.

Figure 42 CENTRE 1
Observed and Proposed Layouts May 1976
Herrera Oria School, Madrid

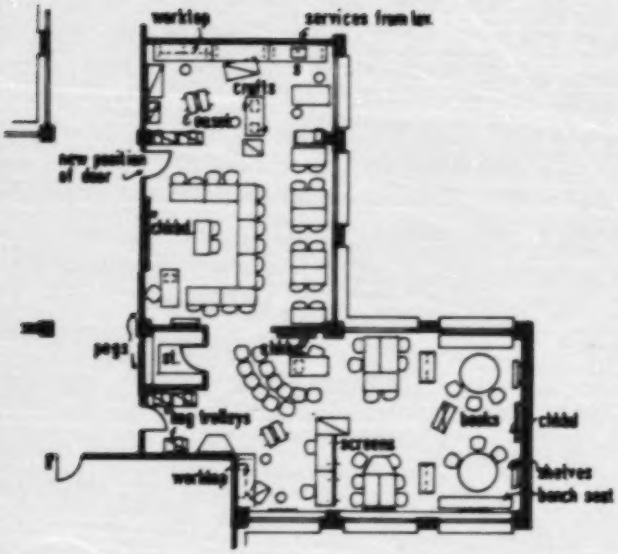


LAYOUT OBSERVED 14/5/76

KEY PLAN GROUND FLOOR



CENTRE 1
70p5-7 yrs.



CENTRE 1 (112-32 sq.m)
LAYOUT PROPOSED MAY 1976

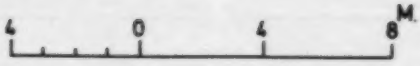
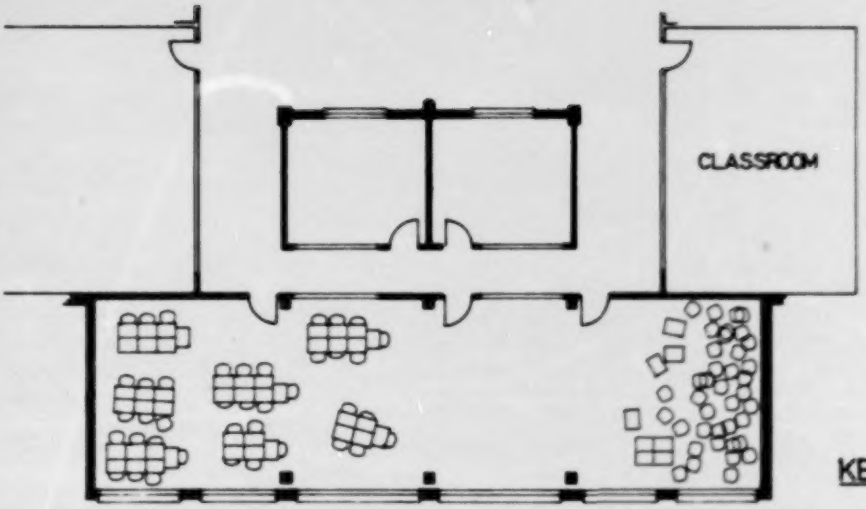


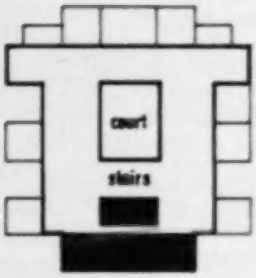
Figure 43 CENTRE 2
Observed and Proposed Layouts May 1976
Herrera Oria School, Madrid

Herrera Oria EGB (6–14 years), Madrid
In this 'control classroom', the only working surface for these pupils (9–10 years) were the single tables (60 cm × 42 cm in area). There was no storage other than the cupboard where books were concealed rather than displayed.

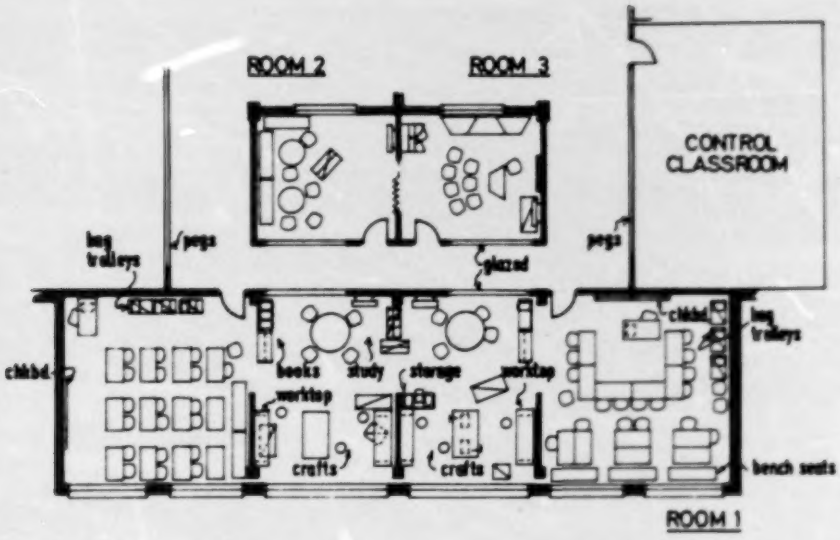


LAYOUT OBSERVED 14/5/76

KEY PLAN SECOND FLOOR



CENTRE 2
70p. 9-10yrs.



CENTRE 2 (166·5 sq.m.)
LAYOUT PROPOSED. MAY 1976

Figure 44 CENTRES 3 AND 4
Observed and Proposed Layouts May 1976
Herrera Oria School, Madrid

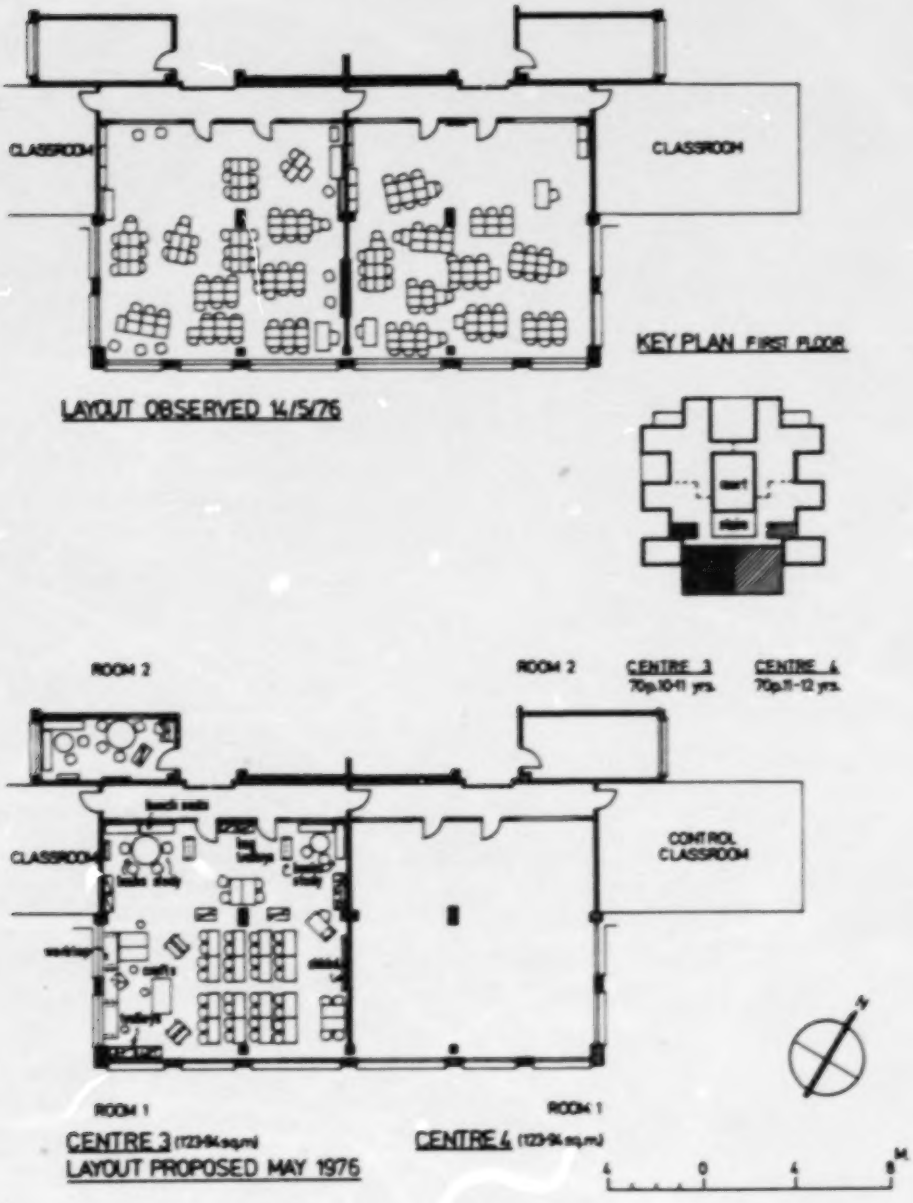
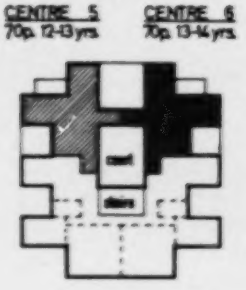
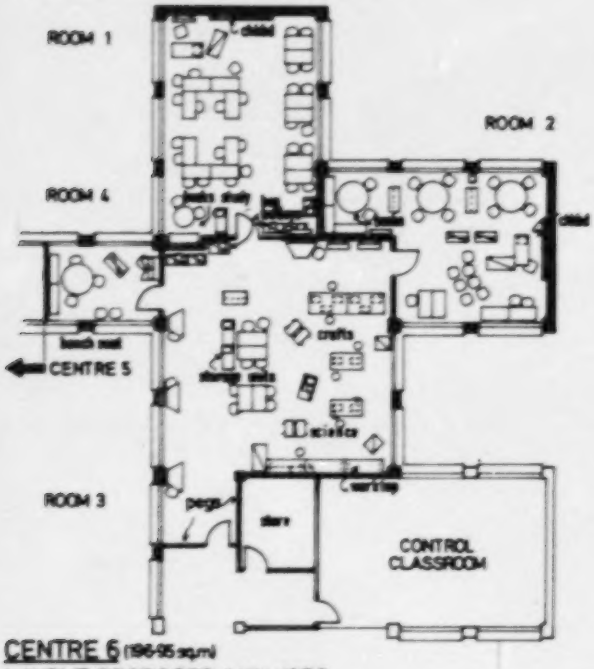


Figure 45 CENTRES 5 AND 6
Observed and Proposed Layouts May 1976
Herrera Oria School, Madrid

LAYOUT OBSERVED 14/5/76

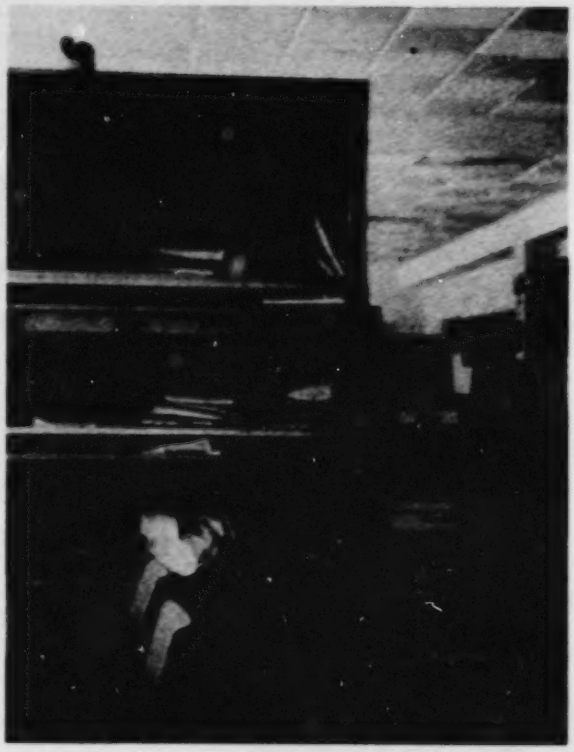


KEY PLAN FIRST FLOOR



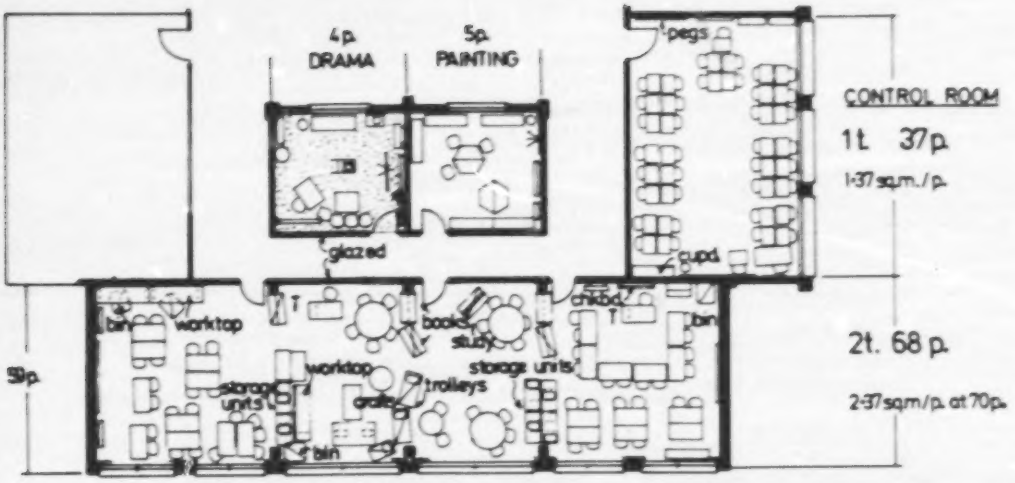
CENTRE 6 (196-95 sq.m)
LAYOUT PROPOSED MAY 1976

Figure 46 CENTRE 2
Layouts Observed May 1977
Herrera Oria School, Madrid

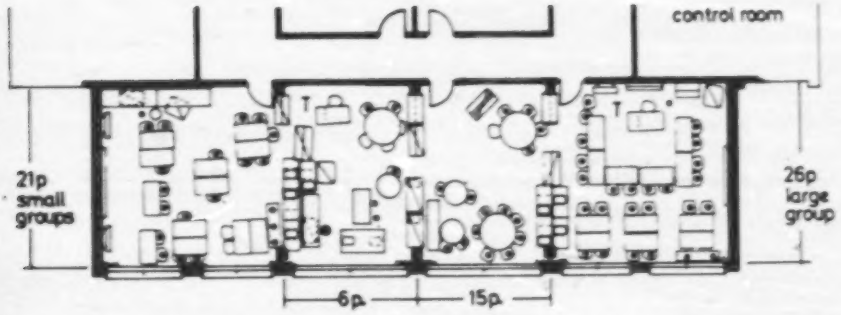


The storage units and book trolley form the division between parts of the Centre and provide storage for bags and personal belongings. The face display of books has increased the frequency of their use.

On the other side of the division seen in the above photo, a teacher is seen with a group at a large round table, and a second teacher in the background at the chalkboard working with a group of 25 pupils. Note the display fitting by the chalkboard.

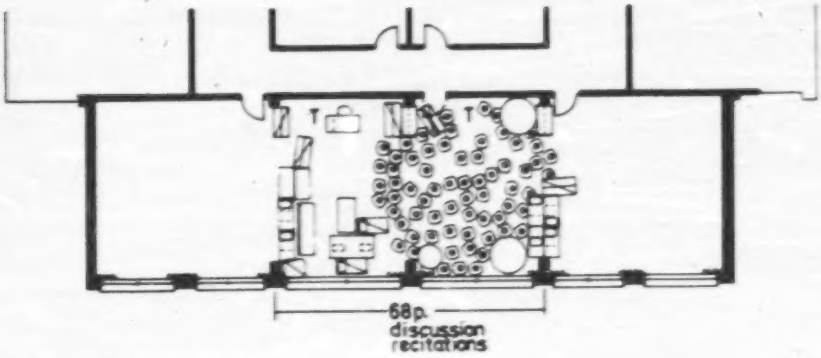


LAYOUT OBSERVED 23/5/77 PM



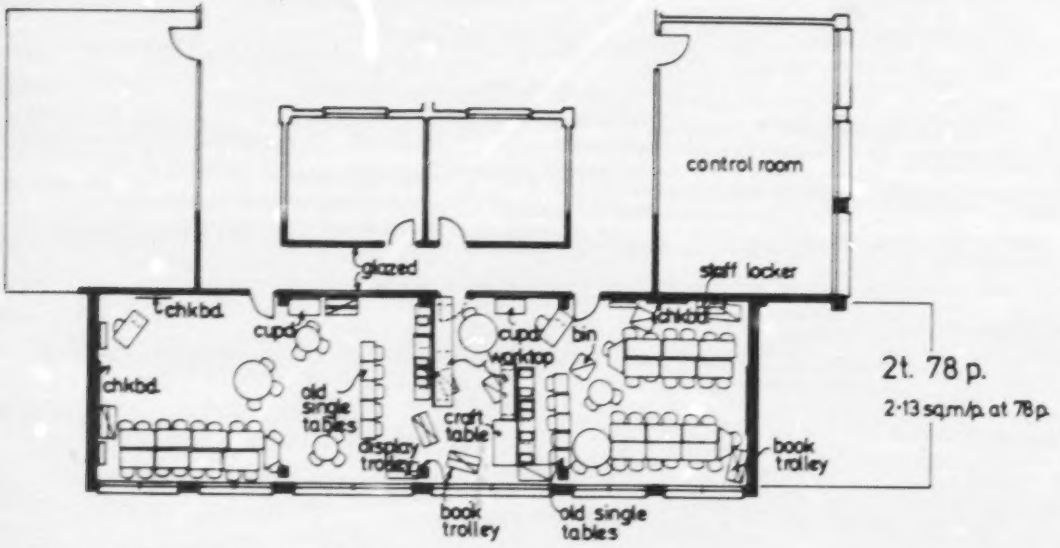
LAYOUT OBSERVED 24/5/77 AM

⊙ indicates position of pupil



LAYOUT OBSERVED 24/5/77 AM

Figure 47 CENTRE 2
Layout Observed January 1978
Herrera Oria School, Madrid



LAYOUT OBSERVED 19/1/78

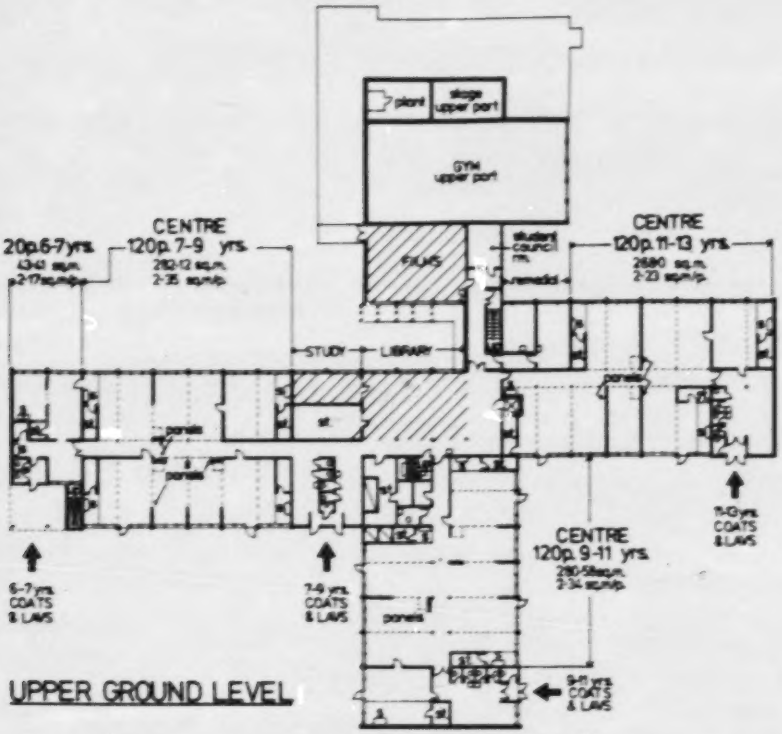
Levre School, Baerum, Norway

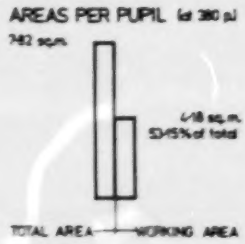
The movable partitions shown in the three wings of the plan at upper ground level do not indicate any of the planned layouts—these are shown in Figures 49–53.

At the lower ground level are the medical and dental clinics which serve the community; they are adjacent to the school administration rooms.

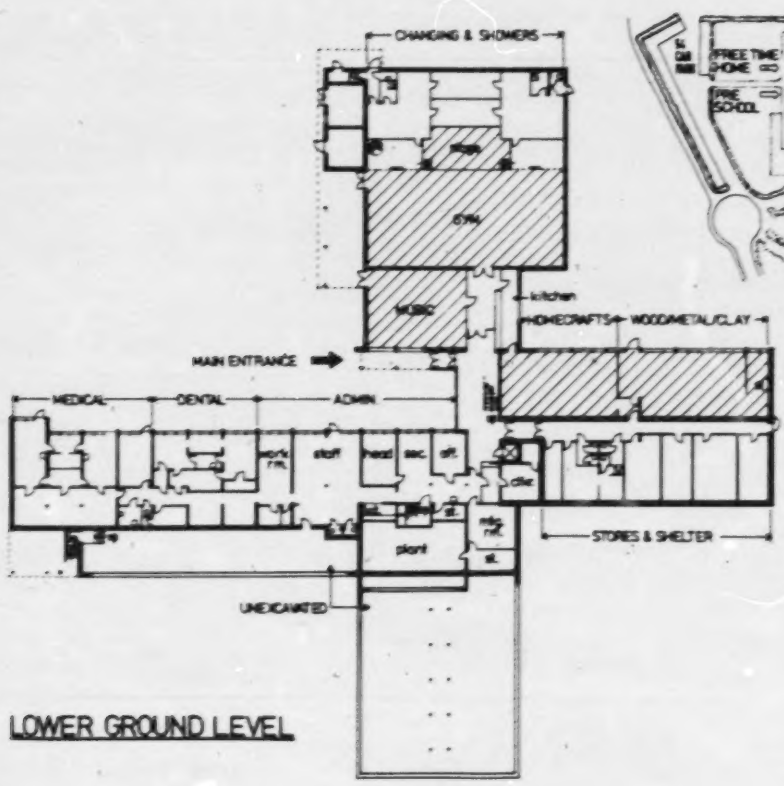
The two plans show the relationship between the "local" work areas and those which are shared by all—which are shaded on plan.

154





ANALYSIS OF AREA



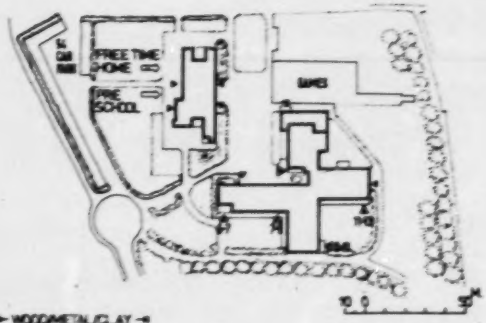
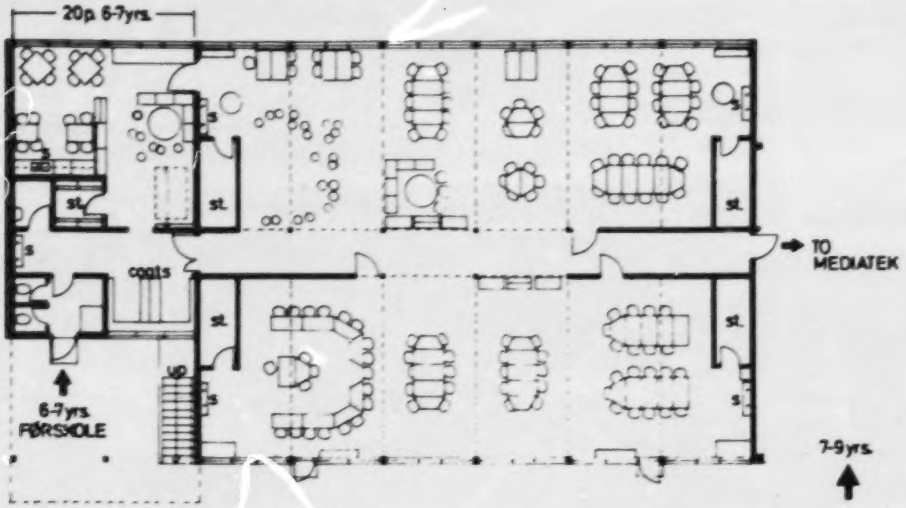
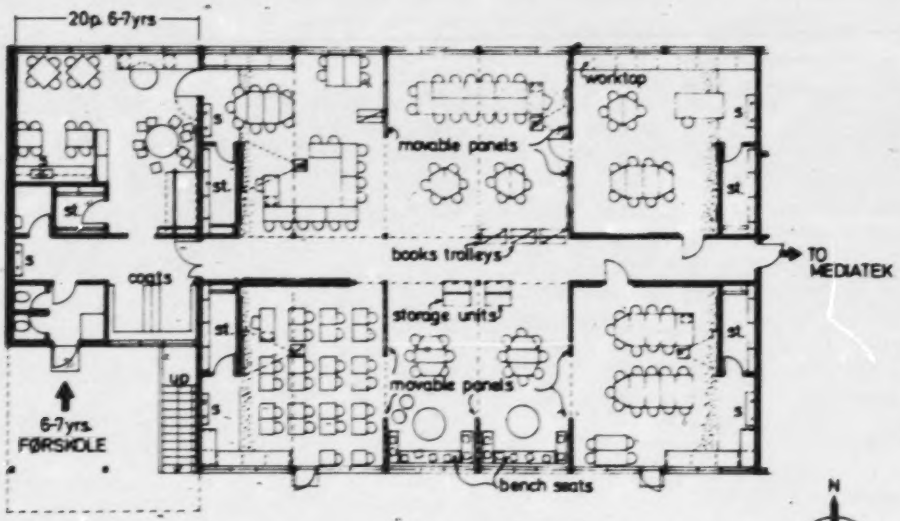


Figure 49 CENTRE 7–9 YEARS
Layouts: Manufacturer's. Local Authority's
Levre School, Baerum, Norway



MANUFACTURER'S LAYOUT BEFORE CONSULTATION (1976) 120p.7-9 yrs.



LOCAL AUTHORITY'S LAYOUT AFTER CONSULTATION (1976) 120p.7-9yrs.

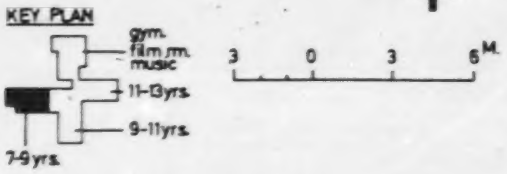
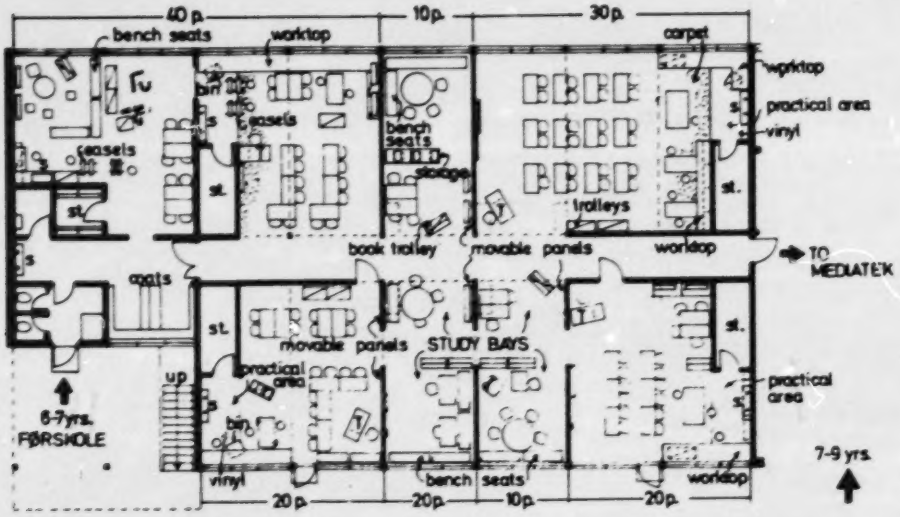
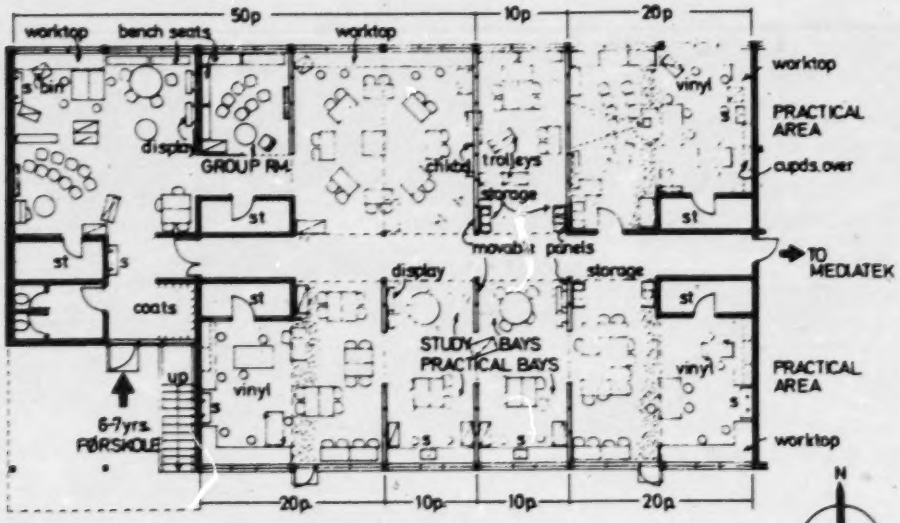


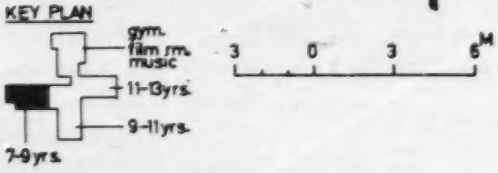
Figure 50 CENTRE 7–9 YEARS
Layouts: Plan Unchanged. Plan Modified
Levre School, Baerum, Norway



PROPOSED LAYOUT NO PLANNING ALTERATIONS. (OCT 1976) 120p.7-9yrs.

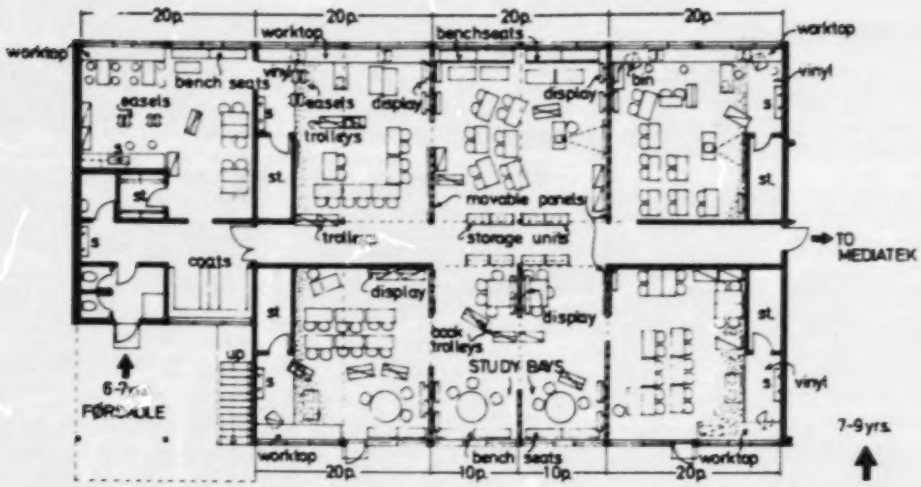


PROPOSED LAYOUT MINOR PLANNING ALTERATIONS (OCT 1976) 120p.7-9yrs.



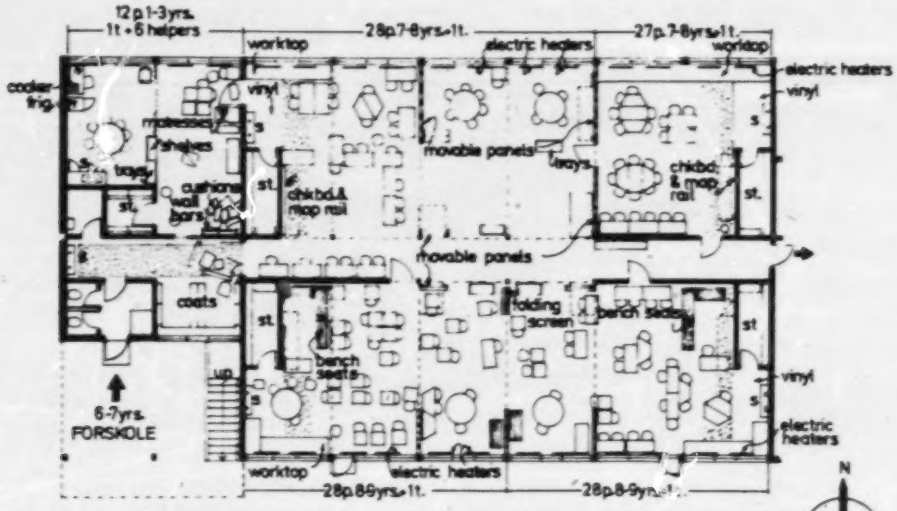
169

Figure 51 CENTRE 7–9 YEARS
Layouts: Final (May 1977). Observed (January 1978)
Levre School, Baerum, Norway



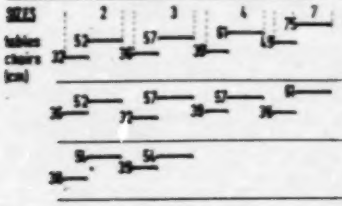
FINALLY NEGOTIATED LAYOUT (MAY 1977)

120p.7-9yrs.



LAYOUT OBSERVED IN USE (31/1/78)

111p.7-9 yrs.



ANALYSIS OF FURNITURE SIZES IN USE

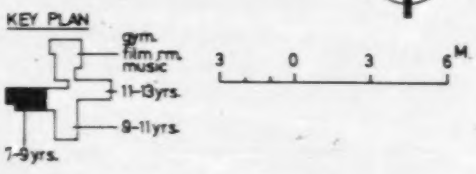


Figure 52 CENTRES 9–11, 11–13 YEARS
Layouts: Final (May 1977)
Levre School, Baerum, Norway

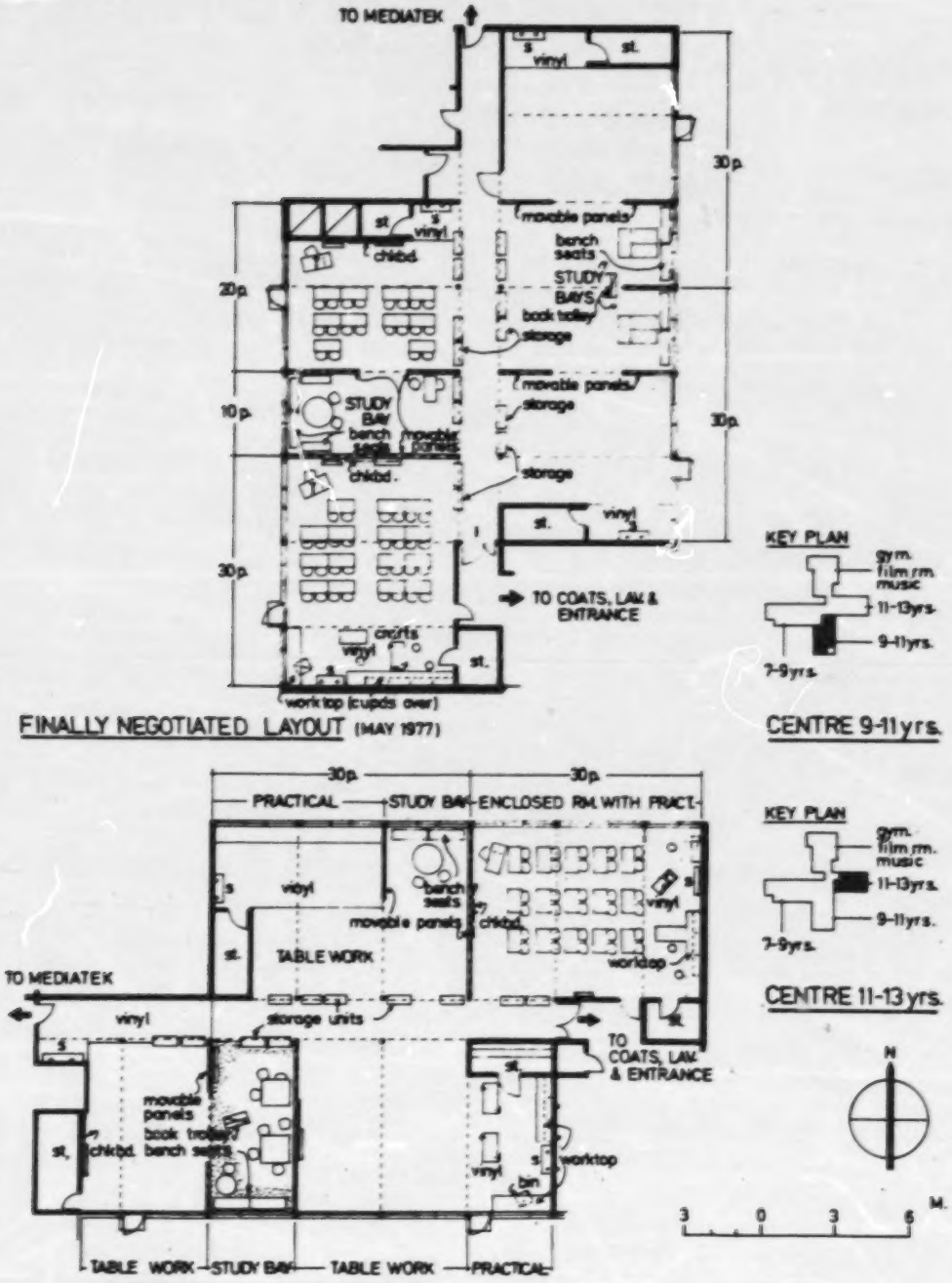
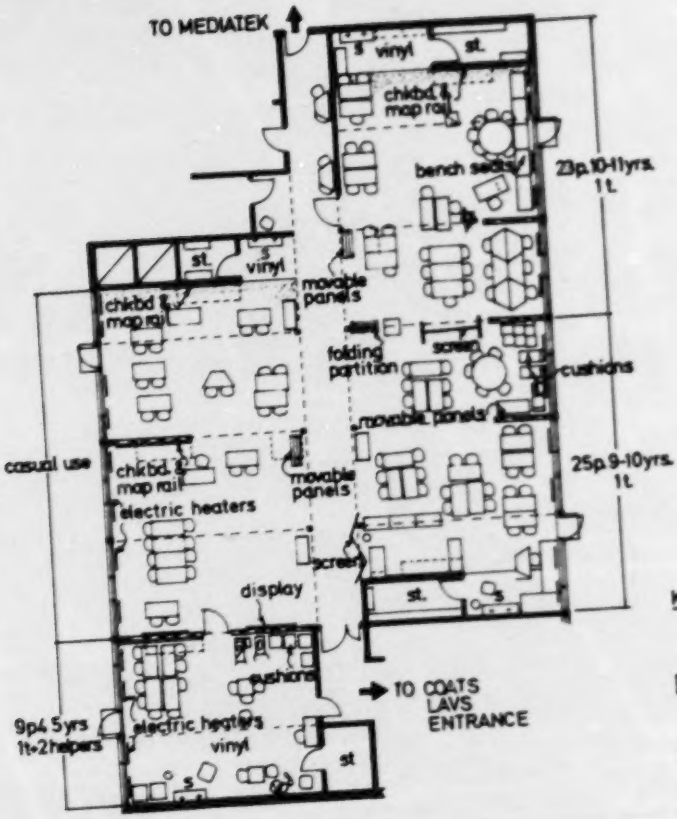
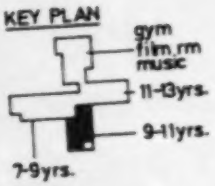


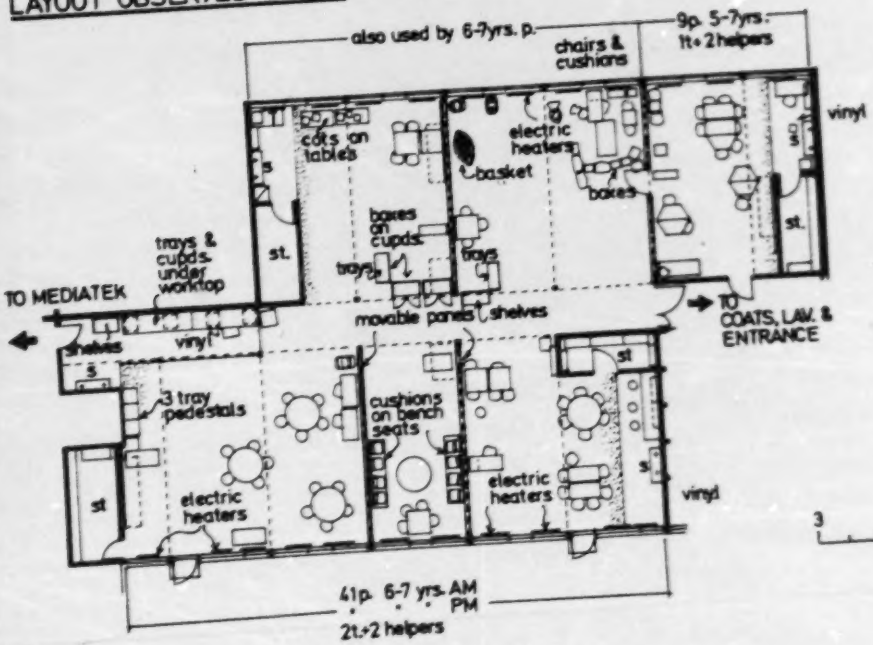
Figure 53 CENTRES 9–11, 11–13 YEARS
Layouts: Observed (January 1978)
Levre School, Baerum, Norway

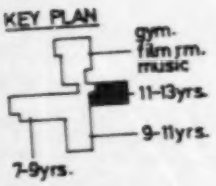




CENTRE 9-11 yrs.

LAYOUT OBSERVED IN USE (31/1/78)





CENTRE 11-13 yrs.

LAYOUT OBSERVED IN USE (31/1/78)

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